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The Welsh Engineers' and Founders' Association
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Contents

	PAGE
What is This Ironfoundry Industry?	305
Foundry Machinery Depreciation	306
Income-Tax Assessment	306
International Bath Association Wound Up	306
Random Shots	306
Mechanism of Wear	307
Manufacture of Spun-Iron Pipes	308
Electricity Supply	308
Deoxidisers Used in Steel Manufacture	309
Magnesite and Chrome Ore Imports	310
Production of Some Engineering Castings	311
Institute of British Foundrymen	313
Contracts Open	313
The Merchandising of Castings	314
Catalogues Received	316
Annual Meeting of Lancashire Foundrymen	316
The Week's News in Brief	318
Trade Talk	318
Personal	318
Obituary	318
Company Meetings	318
Reports and Dividends	318
Forthcoming Events	318
Raw Material Markets	318

What is this Ironfoundry Industry?

We have recently been very disappointed to learn that, after twenty years of continuous effort on our part, there is still so little appreciation of what the ironfoundry industry consists of. For the general public, or even the great officers of State, there may be some excuse, but that people within the industry should be unfamiliar with its somewhat complex make-up is beyond our comprehension. Yet we are constantly receiving evidence that people engaged in manufacturing builders' castings are profoundly ignorant of the rest of the industry catering for machine tools, textiles, printing machinery, the electrical and mining industries, steelworks plant, shipbuilding, agriculture, and so forth. Conversely, foundrymen engaged in the making of castings for some branch of the engineering industries seem to be totally unaware of the existence of the many large and important foundries making builders' castings, including in this category such items as gas and electric cookers, and radiators. Between them, something of the order of three million tons of iron castings are made each year under normal circumstances; the two branches have little in common, and when the engineering trades have been slack, the "light castings" foundries have been busy. At the moment conditions are somewhat reversed, and this has brought about a good deal of loose thinking by many sections of the community. Some "big noises" fondly imagine that the ironfoundry industry is in the same parlous position as, say, the garage trade, whilst others just make it part and parcel of the iron and steel industries and speak of working to capacity. A third group possessing a smattering of knowledge of the industry visualises that the one branch of ironfounding can at a moment's notice be turned over to the other. All these conceptions are false premises, and the situation is as follows:—(1) The ironfoundries making engineering castings are working at high pressure, and this activity has caused the larger ones to farm out a good deal of work to the smaller jobbing foundries, and (2) the "light castings" section is still short of work, though improvement is being registered.

To obtain a proper wartime balance in the ironfounding industry, a survey should be made of flexibility of the foundries, and an effort begun to find work of a national character for the least flexible ones first, doing this of course with as little disturbance as possible. Sight must not be lost of the fact that, like machine tools, certain departments of foundries are virtually "single-purpose machines." If by a slight modification such departments can be adapted to munitions production, then the output would indeed be formidable. By working from this angle, it would leave the most flexible foundries free to fill in the gaps. Naturally, only a person well versed in the structure of the industry and in the requirements of the fighting services and export requirements could tackle such a survey, but there are movements being made which should make such a scheme possible. There is still the necessity of dispelling amongst a very important section of the community the miasma which still apparently surrounds the activities of the ironfoundry industry.

Foundry Machinery Depreciation

Whilst the Ironfounders' National Committee has been formed primarily to deal with the Service departments of the Government, there is a general feeling throughout the industry that attention should be given to the following problem by making representation to the Income Tax authorities. There is insufficient recognition amongst the high officials of the conditions imposed upon foundry machinery. Under normal conditions, that is, with the maintenance department working at maximum efficiency, the useful life of many types of foundry plant is but five years. Nowadays, machines are called upon to work night and day, and it is generally thought that if the war is unduly prolonged, there will have to be a general re-equipment. As the Government take 60 per cent. of increased profit through what used to be called Excess Profits Tax, and then 7s. 6d. in the £ for income tax, there is not much chance of building up capital reserves to take care of future re-equipment. As this affects every undertaking, no exception for the foundry industry is claimed, but what all founders do consider iniquitous is the beggarly 7½ per cent. allowed for foundry machinery depreciation. To expect a moulding machine to have the same working life as a machine tool is to anticipate that pruning shears will outlast a pair of embroidery scissors. Foundry machinery has to work amongst sands, which in other industries are classed as abrasives. Moreover, there may be both steam and moisture in the surrounding atmosphere, whilst a modicum of dust is unavoidable unless extreme (and, incidentally) extravagant measures be taken to protect some part of the plant. As the Budget is to be discussed within the next few days, the matter is urgent, and our readers would do well to make representation immediately to their employers' organisation, so as to adjust depreciation to a figure more in line with reality.

Income-Tax Assessment

By F. J. TEBBUTT

Already the familiar buff envelopes have been received in the daily post, and the following notes concerning assessment procedure may be useful. The return required will be for income in the year ending April 5, 1940, and this applies to both Schedule D (business profits; persons on own account) and Schedule E (employments), although for Schedule D the year-ending date can be earlier, according to the financial year-ending date of the firm concerned (*e.g.*, December 31, 1939).

Assessment Procedure

Broadly, only business profits are assessable. Thus, what may be termed private profits need not be returned, these being anything of an isolated nature, non-recurring, not arising out of the business, such as the sale of a house, of a business, of premises, of goodwill and so forth. On the other hand, private expenses are not deductible, such as drawings, family maintenance, dwelling-house expenses, although if the house is used partly for business purposes, a deduction can be made for rent, annual value, rates, etc., according to the part so used (up to two thirds). Stock Exchange transactions by the individual are usually ignored; incidentally, if profits were charged, losses would be deductible.

Contrasting Matters

Lump sums for legacies, patents, damages, etc., are not assessable; annual payments are chargeable. Unfurnished rooms are not assessable under Schedule D, but supposing rooms are let off of business premises, the rent need not be returned, but a corresponding adjustment must be made in annual value or rent of the whole premises which is deducted. Costs of advertising can be deducted, although if outlay is large, upon such things as hoardings, electric signs, etc., this may be considered as capital expenditure and not allowed. Legal expenses incurred in the course of business are deductible, but not if upon a private matter.

Trade association expenses are invariably allowed, the test being whether the body is for the furtherance of the industry concerned. Donations to charitable institutions are considered as private expenses and are not deductible, but if made in connection with welfare schemes, hospitals, etc., for the benefit of the employees, these are deductible. Expenses in travelling to and from business are not allowed, but expenses incurred in travelling on business are deductible. A loss incurred privately cannot be deducted, but a loss in one business can be set against profits in another business under the same ownership. As regards premises owned, the Schedule A assessment (net amount after repairs allowance is deducted from gross value) is deductible and if the business is a factory business (roughly meaning where machinery is used) a further deduction can be made to the amount of the repairs allowance (Income Tax Schedule A) or one-fifth of the local-authority rateable value (one-sixth gross value in London and Scotland), whichever is the lower amount. This last-named allowance can be claimed by a tenant if he is responsible for the whole of the repairs.

A.R.P. Expenditure

New elements have been introduced recently, such as A.R.P. expenditure, and the following items are deductible as trading expenses: Civilian duty and service respirators; protective clothing for staff engaged on A.R.P. duties; the training of employees in such duties; covering of glass with wire netting; dark blinds; screens and paint to render windows opaque; equipment and stores for first-aid parties; and equipment for decontamination squads. Certain emergency fittings for buildings are also deductible expenses, *e.g.*, steel shutters for protection of windows or timber frames, and screens to provide air-locks at doors and windows. It might be usefully noted also that any allowances made to employees serving with the Forces, or to the wives and children of such employees, are deductible as trading expenses.

Special Points

Amounts for depreciation which may appear in ordinary balance sheets are not deductible under tax law, but an allowance for depreciation of machinery and plant (a very wide term including all motor vehicles, fittings and fixtures) can be obtained under three heads. By the "wear and tear" rule, a percentage allowance is given yearly on the written-down value of the machinery, etc.; by the "renewal" rule the cost of replacements is deductible, this rule usually applying to small items of trade utensils, etc.; and by the "obsolescence" rule an allowance can be obtained for the replacing of obsolete machinery and plant.

The amount is arrived at by taking the wear and tear allowance already taken, off the cost of the old machinery and plant, and anything realised for the old machinery, etc., the amount left ordinarily applying, although if the cost of the machinery replaced is less than this amount, that amount only would apply. Payments for the new Excess Profits Tax or National Defence Contribution, whichever applies, are deductible from income tax assessments.

Conclusion

Wear and tear allowances must be claimed after profits are declared; there is a special space for this claim on the form. There are certain agreed rates which ordinarily apply for different items of machinery, etc., under this rule, and it should be noted that all these percentage rates are subject to an increase of one-fifth of the percentage (Finance Act, 1938), *e.g.*, the ordinary rate for motor vehicles is 20 per cent. per annum, add one-fifth, and the rate to apply is 24 per cent.

International Bath Association Wound Up

A petition has been granted for the compulsory winding up of the International Bath Association, Limited, presented by the company and the British Bath Manufacturers' Association, Limited, Glasgow, contributories of the company. It came before Mr. Justice Simonds in the Chancery Division on April 15.

Mr. Cecil Turner, for petitioners, said this was a joint petition by respondent company, and the preponderating shareholders—a British company. The International Bath Association, Limited, was formed with eight directors, four of whom were British and four German. It was now impossible to contact the German directors or to get a majority of directors to sign a solvent liquidation. The petition was brought partly for that reason and partly for the fact that the whole business of the company had come to an end by reason of the war. The business consisted almost entirely of an Anglo-German commercial undertaking which depended upon mutual financial and commercial relations between the German and British elements.

Mr. Turner said the Custodian of Enemy Property had been communicated with, and he saw no ground for opposing the petition.

Mr. Justice Simonds said he would make a compulsory winding-up order.

Monel Metal and Nickel Alloys

The current number of "Monel Notes," available from Henry Wiggin & Company, Limited. Thames House, Millbank, London, S.W.1, includes articles on the manufacture of Inconel exhaust manifolds, the hardening of K Monel and factors involved in the selecting of a spring material. This issue will no doubt interest the numerous firms who are now using Monel, nickel and Inconel for the first time.

Random Shots

The success of the vitreous enamelling exhibition which was held in London can best be summed up by saying how many Midlanders came to criticise and went away impressed. Indeed, it is even true to say that the exhibitors themselves were amazed to see how everyone with anything to show rallied to the effort, for the whole affair was not only spontaneous in conception, but spontaneous in effect, and equally so in its success. Of the premeditation and pre-arrangement, so "Marksman" is told, there had been the barest minimum, and although most members brought their exhibits along with them, there was not a sign of that last-minute desperate finishing of stands so familiar at all large-scale exhibitions. In fact, so successful was the idea that the various Branches of the I.B.F. might at some time try out the idea. It would be good to see the representative of Brightside Foundry, for instance, strolling into the local hotel with a 140-ton ingot mould in his overcoat pocket!

* * *

Incidentally, at any display of vitreous enamelled goods "Marksman" is impressed by the double function of that particular method of finishing metals. At one end of the scale is its strictly useful application to domestic appliances, in which such phrases as "durability," "hygienic in use" and "labour-saving" are the watchwords. At the other end is the purely decorative use for jewellery, badges, *objets d'art* and the like. For these, one can express nothing but admiration, especially for the beauty and depth of colour. At present, the two ends of the scale are kept reasonably apart, but enamellers might fear a new nightmare in which housewives demand that their gas stoves and refrigerators have all the practicability of domestic vitreous enamelling and all the beauty of art enamelling. Indeed, the tendency is already evident in the demand for beautiful pea-green bathrooms and delicate primrose kitchens in which everything is a perfect match.

* * *

The ironfounder, too, seems to be suffering from a dose of the same complaint, as a graphic sentence from "The Iron Age" indicates. "Foundrymen are expected to produce castings with all the attributes of a rubber band, the Maginot Line and Ann Sheridan—and all at a price competitive with second-hand newspapers." One can almost hear the author groan as he writes it, and many a practical foundryman will groan in sympathy!

* * *

Speaking at a recent dinner of industrial chemists, Mr. W. S. Garland showed a special understanding of the industry when he said of foundry chemists that they were subject to declension like a certain Latin noun which goes "seek 'em, suck 'em, sack 'em."

* * *

In a dentist's waiting room was seen a piece of knitting that bore the request: "If you have to wait, you can help by knitting a few rows." The idea was excellent. The only snag will come when the dentist has to decide whether he ought to stop it or pull it out!

* * *

The Last Inducement

In the window of a stamp-dealer's shop was displayed one of those blocks of four stamps of Hitler surrounded by a considerable edging of blank paper, which were put on the market some time ago. Evidently the dealer was overstocked in this particular line, for underneath the display was a large notice which read "Good for dartboard!"

"Marksman."

Mechanism of Wear

RESULTS OF RECENT RESEARCH WORK

At a recent meeting of the South African Institution of Engineers, Mr. T. U. Matthew presented a voluminous Paper* on the subject of "The Mechanism of Wear," pointing out in some introductory notes that metallic wear is a fundamental problem in every branch of mechanical engineering for the simple reason that a wear condition exists wherever two surfaces move in contact with each other. The annual cost of wear in machine parts throughout the world, quite apart from the wear on roads and rails, and the cost of continual replacements and repair work, would be a staggering figure if it were possible to assess it. In mining, for example, hundreds of tons of metal in the shape of rock-drills, jack-hammers, scrapers, ore-mill balls and liner plates are being worn away against rock surfaces each year, and a rough estimate indicates that the cost of wear, including the labour costs entailed in drill sharpening, mill liner replacements, etc., on the Witwatersrand alone, exceeds £5,000,000 per annum.

Another aspect of frictional wear is the power which must be expended to overcome frictional resistance, and the fact that this power is largely converted into heat. Thus, if W is the contact pressure in lbs.; u the coefficient of friction, and v the sliding speed in feet per minutes—

$$\text{The heat units generated} = \frac{Wuv}{778}$$

B.Th.U. per min.

The actual temperature rise in the bearing is, of course, dependent upon the thermal conductivity of the bearing metals, the cooling action of the oil film, and the external cooling of the bearing by means of water jackets. Nevertheless, it is easy to see that an increase in the coefficient of friction from, say, 0.001 under normal conditions, to a value of, say, 0.100 under boundary lubricating conditions when the supply of oil fails, will increase the heat units generated 100 times and necessitate an immediate shut-down of the plant. Millions of horse-power must be expended annually on overcoming frictional resistance, and even in the best power units occasional breakdown occurs due to bearing trouble.

Special Cast Irons Used

Engineers in every field of design are thus continually on the lookout for new lubricants, new steels, and new bearing materials which are able to withstand ever-increasing bearing pressures, operating temperatures and rubbing speeds, and able to maintain working clearances within ever finer limits. New bearing materials and wear-resisting materials are continually being discovered, which go a long way towards meeting these needs. Alloy steels have been found with exceptional wearing properties in many cases, and are being used increasingly in practice. In some cases special cast irons are found to be preferable for economic reasons. Anti-friction bearing metals have also been successfully developed by "trial and error" methods, to meet more and more exacting conditions of service. Finally, new types of "oily" and "solid" lubricants have been developed for service in extreme conditions.

In spite of the great progress that has been made in this way, the actual mechanism of wear between two sliding surfaces is only now being made known. Fundamental research on this problem is a comparatively recent development, but already theory is rapidly gaining on practice, and in a very short time it is probable that bearing metals and materials for cutting tools will be designed, rather than discovered, for a given service.

In the remainder of the Paper the author deals briefly with the main results of scientific research on the wear of polished surfaces, and relates recent developments in the technique of wear-resistance with the new knowledge of the wear process. We append the author's conclusions.

Conclusions

The most important results obtained from research on the mechanism of wear indicate that initial wear during the running-in of surfaces is dependent upon the type and degree of surface roughness left by the machining operation. Polished or run-in surfaces have an amorphous layer formed gradually from metal particles. Oxide films exist in all surfaces and influence wear considerably, and oxidation wear occurs in cases where the oxide film is continually being removed by the movements of contacting surfaces, even with lubrication.

Sliding contact temperatures under high point loads and speeds may be as high as the melting point temperature of the metal. With steels, temperatures above 1,000 deg. C. have been measured even when lubricated. Seizing takes place readily between absolutely clean surfaces at normal temperatures, although high temperatures cause plasticity of the contacting points, and thus assist seizing on contaminated surfaces.

As two surfaces move together in contact, friction is caused by a continual seize-shear action at the points of contact. Seize-shear is associated with the metal slip-planes and does not occur regularly on graphited surfaces where the slip-planes are parallel to the surface. Seizure does not take place on compressed-fibre surfaces owing to the self-lubricating nature of the surface. Nevertheless, such surfaces wear steel rapidly by oxidation wear and polishing action.

Similarly, the most important general results obtained from service wear tests indicate that hardness is not a reliable index of wear-resisting properties, and that metallic wear is proportional to bearing pressure and sliding speed. The type of lubricant used greatly affects wear, which is also much influenced by oxidation. Wear is largely influenced also by humidity, and, finally, wear resistance is a function of the coefficient of friction.

Application of Wear Theory to Recent Developments in Engineering

Consideration of the results obtained from service wear tests and from experiments on the mechanism of wear throw considerable light on the basic reasons for several developments in wear-resisting technique.

These developments will be considered in relation to the four main types of wear problem which exist in engineering practice, namely:—(1) The wear of cutting edges; (2) the wear of materials subject to high temperatures and oxidising conditions; (3) the wear of materials subject to high impact-loading conditions; and (4) the wear of lubricated bearing surfaces.

(1) *The Wear of Cutting Edges.*—The wear process is mainly controlled by the contact temperature developed. Cutting edges are subject to high sliding speeds and intensive point loading, leading to localised contact temperatures approximating in the limiting case to the lower melting-point temperature of the opposing metals. The obvious solution has been the development of cutting-edge materials with the highest possible melting-point temperature. The use of tungsten-carbide tool tips for high-speed cutting of metals, and the use of diamond and corundum-tipped drills for high-speed rock drilling is, therefore, founded on a sound theoretical basis. The melting point of tungsten carbide is about 2,860 deg. C., of corundum about 3,000 deg. C., and diamond 3,600 deg. C.

(2) *The Wear of Materials Subject to High Temperatures and Oxidising Conditions.*—In this class, which mainly concerns internal-combustion engine valves and other parts which normally work at high temperatures, the creep strength of the metal must first be taken into account, and this limits the range of available materials considerably. Then, if the initial temperature of the surface is high, the temperatures due to sliding contact must obviously be still higher, depending on the sliding speeds and point loading. The general high temperatures, however, make oxidation resistance the main criterion for choosing suitable wear-resistant materials. Hence the use of Monel metal and other nickel-chromium steel alloys which combine good mechanical properties at high temperatures with very thin, but protective, oxide films on their exposed surfaces.

(3) *The Wear of Materials Subject to High Impact Loading Conditions.*—With materials subject to high impact-loading conditions, mechanical strength and work-hardening properties are a primary consideration. A 12 per cent. manganese steel, for example, is noted for its ability to develop an extremely hard, wear-resistant surface layer during the running-in process. Several nickel-alloy cast irons, such as Ni-hard, have also been found to form extremely resistant surface layers under conditions where high surface loads are applied by extremely abrasive materials. In the case of cast irons, however, it is suggested that where the carbon is in a graphitic form, the surface layer is also self-lubricating to some extent, and is thus enabled to resist seizing action. The development of self-lubricating and work-hardening materials for arduous service is, therefore, likely to continue. It is suggested that the self-lubricating properties of surface layers in such materials might be stimulated to some extent by the addition of colloidal graphite.

(4) *The Wear of Lubricated Bearing Surfaces.*—The wear of lubricated bearing surfaces is, of course, much more a function of the type of lubricant used than of the metals. As long as the metals are kept from contacting, wear is impossible except perhaps by the corrosive action of the lubricant. Highly-loaded bearings or bearings starved of lubricant soon develop a condition of boundary lubrication, however, and this condition eventually leads to contact being established, and eventually to seizure. Where lubrication is normally adequate to prevent continuous contact in service and boundary lubrication conditions only occur during starting up and under impact loads, soft plastic "anti-friction" metals are used to reduce friction losses.

Where boundary lubrication conditions obtain during the entire running period, as in heavily-loaded ball races, the choice lies between (1) the use of wear-resisting steels and cast irons, or (2) the use of self-lubricating metal surfaces formed either by the use of colloidal graphite during running-in, by forming a porous bearing surface by metal spraying, by using porous self-lubricating alloys formed by the compressed-powder method, or by the use of compressed-fibre bearings which are not only self-lubricating, but which also have non-seizing properties when used with steel.

D

* Published in the Journal of he Institution.

Manufacture of Spun-Iron Pipes*

By S. SPRAY

Centrifugal casting is no new thing. The first Patent was taken out in 1809, but the experimental development of the process as applied to pipe making was originated by de Lavaud in 1914. The commercial development was not put into large-scale practice until 1922, when the Stanton Company was the first undertaking in the world to see the possibilities of the process. The erection of a plant in that year now gives them a record of 18 years of manufacture of spun-iron pipes. The process was later taken up by firms in America, France and Germany.

The spinning machine consists of a water box containing a steel mould rotating on friction rollers and driven by an electric motor. The whole is mounted on rollers on a steel track which is part of the machine bed, and longitudinal movement is obtained by hydraulic cylinder and ram. At the head of the machine is a tilting hopper, the capacity of which is just sufficient to cast one pipe. From this hopper, molten metal flows down a fall spout and along a cantilever trough which runs the length of the mould.

When a pipe is made, a sand core forming the internal shape of the socket is fixed in position in the socket end of the mould and the machine is moved up to the top of the track.

The mould is revolved and when it has attained the correct speed, the hopper which has previously been filled with molten metal commences to tilt. The metal flows down the trough into the mould at the socket end. When the socket portion is full, the machine travels in a downward direction, and a continuous spiral of metal is deposited over the inner surface of the mould. Centrifugal action holds it against the sides of the mould. The spiral coalesces and forms the pipe.

Close control of the movements of tilting hopper and machine and of the mould rotation speed can enable any required thickness of pipe to be produced. The metal solidifies and contracts in a few seconds and stripping is accomplished by securing the pipe at the socket end with internal grip tongues while the machine is traversed back to the upper part of the track. The pipe is then successively passed through a normalising furnace, mechanical scrubber, coating bath and hydraulic-pressure test pump.

The fracture of a spun pipe is much closer than that of a sand-cast pipe, and the tensile strength is 15 to 20 tons per sq. in., whereas the same metal cast in sand would only carry 10 tons per sq. in.

The Mairey Process

The Mairey process consists of the feeding of a stream of finely-powdered ferro-silicon into the mould just ahead of the molten metal [as was shown in a film which the author displayed]. Without this powder, the molten iron becomes chilled immediately on coming into contact with the water-cooled mould. Cementite is formed on the outside portion of the section and this, without annealing, makes cutting, drilling and tapping the pipe very difficult.

The process prevents the formation of chill during casting, partly because the air between the particles of powder expands and forms an insulation between the metal and the mould and partly because of the action of the ferro-silicon in helping the precipitation of graphite from the molten iron. It is thus possible to have controlled conditions of cooling. In the old process a high temperature was necessary to split up the cementite present in the pipe; even so, the graphite was precipitated in a nodular formation. With the Mairey process the outer half of the section has a non-brittle dendritic structure resulting in high values of tensile strength and impact test. Much less severe heat-treatment is required as pearlite only has to be split up.

It is interesting to note that in pipes having a thin wall, as for example a 2-in. diameter pipe, the metal has a dendritic structure throughout the whole of the section, and it gives a ring-test tensile strength of 26 tons per sq. in.

DISCUSSION

MR. A. F. HAMMOND asked what was the temperature of the water-cooled mould.

MR. SPRAY said the cooling water was maintained at 150 deg. F. Moulds crazed from the heat and needed reboring at intervals, although the Mairey process using ferro-silicon powder in advance of the metal stream doubled the life of the mould. No liner was used in the nickel-chromium steel mould, which would produce about 10,000 pipes during its life. The diameters of pipe manufactured ranged from 1½ to 24 in. dia., but 6-ft. lengths of 36 in. dia. had been spun.

MR. A. H. HORTON inquired about the rate of cooling after normalising, and also the impact value of the spun iron.

MR. SPRAY replied that pipes travelled automatically through the normalising furnace and remained there for about 15 min. in the hottest zone, taking a further ½ hr. to reach 250 deg. F., when they were immersed in the bath of bitumastic coating compound; the residual heat helped to harden the coating. The only impact tests carried out were made upon the actual pipes under hydraulic pressure.

MR. H. H. SHEPHERD said that Izod impact tests on cast-iron test-bars were unsatisfactory because of the short range of readings between the most brittle and the toughest irons.

MR. J. L. FRANCIS referred to the continuous working of the cupolas using syphon bricks, and asked if desulphurisation was carried out.

MR. SPRAY said that the sulphur was controlled at 0.09 per cent., and if necessary desulphurisation was effected using soda ash in the tilting receiver. The grade of ferro-silicon used in the Mairey process was the 75 per cent. silicon type, ground so that it all passed the 100-mesh sieve and three-quarters of it must pass the 200-mesh sieve.

MR. SHEPHERD, remarking upon the excellent test results from the pipes, although phosphorus content was relatively high, said he was of the opinion that substantial proportions of phosphorus could be safely used in many cases where low ratios were stipulated. He asked the lecturer how phosphorus affected the corrosion of pipes.

MR. SPRAY replied that phosphorus was valuable in promoting fluidity necessary to the spun process, especially for pipes of small diameter. Corrosion tests on spun-iron pipes showed that the phosphide eutectic areas were the last to be attacked.

Finally, the CHAIRMAN proposed a cordial vote of thanks to Mr. Spray, which was heartily endorsed. He also acknowledged the kindness of the Ipswich Film Society in providing and operating the film projector for the showing of the film which illustrated Mr. Spray's lecture.

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* Summary of a lecture to the East Anglian Section of the Institute of British Foundrymen, Mr. H. H. Shepherd presiding. The author is on the staff of the Stanton Ironworks Laboratory.

MR. A. S. BEECH, chairman and managing director of Foundry Equipment, Limited, Leighton Buzzard, has been elected a member of the Institution of Mechanical Engineers.

Electricity Supply

C.E.B. REPORT FOR 1939

The 1939 Report of the Central Electricity Board up to December 31 last reflects the effect of the war on the normal course of the Board's activities during 1939. It is inevitable, it states, that the war must have a serious effect on the Board's trading results, and the accounts show that there has been a pause in normal expansion of the trading balance, explained principally by the falling off, brought about by the war, in the maximum demand at the end of the year.

One effect of the war is that much detailed information of the kind recorded in previous years with respect to the expansion and operation of the Grid and the generating stations associated with it is withheld. It can, however, according to the Report, be confidently asserted that the existence of the Grid, which owes its origin largely to a recognition of the deficiencies in the organisation of the electricity supply industry as a whole during the war of 1914 to 1918, is a material factor in increasing the contribution of the industry to the present national war effort.

On the outbreak of war, the Board undertook a survey of the probable effect on the demands for electricity. A preliminary examination indicated that demands were likely to be substantially below the peace-time estimates and that, if the pre-war plant extension programmes were carried out in their entirety, there would, during the war and for some time thereafter, be a substantially greater margin of spare plant than had been considered adequate when the programmes were settled. It was already too late to cancel to any appreciable extent the arrangements for plant included in the programmes for 1939, 1940 and 1941, nor would that have been prudent, having regard to the added war risks.

Plant Extension Programmes

The Board decided that it would be commercially unsound to proceed with the full programme of plant extensions for 1942, which had been framed on pre-war estimates, and it arranged for the postponement of certain extensions and new stations which were in hand, but for which firm contracts had not been placed. These arrangements were such that some of the plant deferred could be quickly put in hand again if any material change in the circumstances should occur to render that course desirable. The black-out and the curtailment of non-essential industries, despite the increase in munition work, have already caused a substantial reduction in the aggregate maximum demand made by authorised undertakers on the Board, and it appears improbable that any material increase in that aggregate will take place during the war. The completion of the plant-extension programmes for 1940 and 1941 and the modified programme for 1942 will, therefore, result in an increasing margin of spare generating plant as the war proceeds.

Many undertakers, faced with prospective increases in their overhead charges and shrinkage of their sales, have already found it necessary to increase their prices for supplies, and it seems that these factors must in due course lead to an increase in the Board's tariffs. The Board hopes, however, that the completion of its survey of the effects of the war will show that such increase can be avoided in 1940.

A scheme has been devised for safeguarding electricity supplies and provides for the establishment and administration by the Board of a pool of switchgear, transformers and other equipment which can readily be made available to replace temporarily apparatus belonging to the Board or other undertakers in the event of damage consequent upon hostile attack. The cost of the scheme is £3 million.

Deoxidisers Used in Steel Manufacture

Deoxidation of molten steel was the subject of a discussion initiated by Mr. Howard Bier at a recent meeting of the Sheffield Metallurgical Association, when Mr. H. H. L. Lockley (President) occupied the chair.

MR. BIERS, at the outset, said he had not had the advantage of very much experience with British steelmaking practice although he had studied deoxidation processes on the Continent and in America for several years past.

Deoxidation to a greater or lesser extent is necessary in the manufacture of all metals and alloys. As far as steel was concerned the term "deoxidation" originally meant reducing the oxygen content and for a long time this definition was quite adequate. Physical tests for steel were simple and some of the finer points of toughness, impact strength and grain size had not then been appreciated. During that period the principal problem confronting the steelmaker as far as deoxidation was concerned was the cheapest way of reducing the oxygen content. Manganese and silicon were generally used for this purpose, silicon being more effective and generally cheaper than manganese. By effective, it is meant that steel containing 1 per cent. of silicon would have a lower oxygen content than steel containing 1 per cent. of manganese. When it became necessary to reduce the oxygen content still further without altering the composition, aluminium was added in the ladle.

As requirements became more severe, and this was the beginning of the alloy-steel age, the deficiencies of past deoxidation practice gradually became apparent. Both steelmakers and users began to appreciate that the products of deoxidation which remained in the steel could have deleterious effects. The result of this appreciation was an urge towards clean steel, that is steel containing no inclusions—as the products of deoxidation remaining in the steel were called.

Deoxidation and Elimination of Inclusions

More recently the concept of deoxidation had changed to mean reduction of the oxygen content coupled with elimination of inclusions. The most recent trend included deliberate inoculation for special effects but it was significant that that stage of development passed through the clean steel stage. In other words, accurate control of the steelmaking process, including grain-size control, depended on establishing an initial state of deoxidation and cleanliness from which the effects of special deoxidisers could be evaluated.

Any number of elements could be used to deoxidise steel. These included manganese, silicon, aluminium, chromium, titanium, zirconium, niobium, molybdenum, vanadium, etc. The physical metallurgist would probably group them all as those elements the formation of whose oxide, under the conditions involved, was accompanied by a greater decrease in free energy than the formation of iron oxide in the same circumstances. Naturally, rate of reaction was also very important.

The speaker then discussed some of these elements in the following order:—Carbon, silicon and manganese, calcium, titanium, zirconium.

Carbon as a Deoxidiser

Carbon, he said, was perhaps the most valuable deoxidising agent. It was used in all steelmaking processes to a greater or lesser extent, being always present in the charge and involving no extra expense. While good steel could be made using no other deoxidisers, for practical purposes manganese and silicon were almost always added because the velocity of the carbon reaction decreased very rapidly as equilibrium was approached. For practical purposes, therefore, the bath was usually "stopped" by the addition of manganese, or preferably by the addition of silico-manganese of appropriate composition. This composition was that in which the manganese to silicon ratio was greater than 3½ to 1. The speaker showed actual figures of inclusion counts on random heats manufactured by that procedure in which the total inclusions were considerably lower than with previous practice.

The use of silico-manganese did not mean that manganese and silicon could not profitably be used independently. As a matter of fact, they were used independently to a very large extent, but the speaker emphasised that the silico-manganese treatment offered perhaps the best and most reliable method of establishing an initial level of oxygen content and cleanliness in the bath. This treatment would provide minimum variation from heat to heat and consequently would permit accurate evaluation in the effects produced by subsequent treatment.

The remaining elements discussed individually were those generally added to the ladle. Aluminium was the most important of these although very careful control was necessary to prevent producing dirty steel. Combination alloys of aluminium had not been much more successful, possibly because the rate of reaction of the aluminium was so comparatively great that unless sufficient oxygen were present for all the ingredients in the alumina inclusions would form. Aluminium produced very fine-grade steels although vanadium was a competitor if the additional price could be borne.

Calcium and Zirconium

Calcium was an interesting element and was particularly effective in destroying grain-boundary network inclusions in steel castings. Calcium uniformly gave coarse-grained steel, possibly due to its small solubility of about 0.01 per cent. Calcium's effect on fluidity and surfaces was also important.

Zirconium was really a compensating deoxidiser since it alone of the elements commonly employed was active toward oxygen, nitrogen, sulphur and phosphorus. Zirconium treatment was beneficial for almost all alloy steels, the advantages being recognisable in improved impact strength and uniform intermediate grain size of, say, 4 to 7 on the McQuaid-Ehn test.

DISCUSSION

The PRESIDENT said that one of the author's points which was interesting to him was the deoxidation which could be obtained by carbon only. In the Swedish Bessemer process, for instance, the metal was blown from a 4 per cent. manganese and about 1 per cent. silicon pig-iron. The blow was stopped when the desired carbon was attained, the residual manganese being about 0.25 per cent. No additions of deoxidising materials were made in the converter and only a small piece of aluminium was put into the moulds. The shallow hardening steels which were coming into vogue at present were made in Sweden many years ago, and many tons had been sold in Sheffield. With regard to zirconium, Mr. Biers did not mention that it was often added to high-speed steels in the final stages of the melt in order to avoid carbide segregations, especially in large ingots. He should like to know from the author why calcium-manganese-silicon additions gave better surface on high-chrome steel than calcium-silicide additions.

Ironfoundry Experiences

MR. R. C. TUCKER said it was a fact that cast irons did vary in their oxygen content as they came out of the furnace, particularly cupola-melted cast irons. Not for many years, in their foundry, had they added any deoxidiser to cupola-melted cast iron. When he first came to Sheffield ten years ago aluminium was added to the ladle.

But he did add deoxidisers to crucible-melted cast iron which had been superheated and therefore had a chance of becoming oxidised. The superheating gave a chance for all the initial deoxidation products to rise to the surface, and it was a fact that in cast-iron practice if they allowed those initial deoxidising slag particles to rise right out of the metal they removed the nuclei on which the graphite flakes started to form. If at a certain point they let that metal cool down they got fine graphite, but if they went further and continued their superheating too long they got an entirely different structure in the metal, and instead of getting fine graphite and pearlite, which gave strength, they got fine graphite and ferrite, and he felt that that was due to the final elimination of all silicate and sulphide particles, giving an entirely different internal condition. That brought them back to the old problem of why aluminium controlled the grain size in steel. They were told that it was due to the actual presence of the alumina particles in the steel, which interfered with the growth of the grains. He wondered if Mr. Biers belonged to the school which thought that that happened. He had used calcium-manganese-silicon for deoxidising a 33 per cent. chromium cast iron containing about 1½ per cent. to 2 per cent. carbon, and he could not say that he had found very much change in the properties of the metal whether he made that addition or not. He added it because it was more or less fashionable to do so, and he certainly had not found any change in the cleanliness of the metal. What he did find was a change of fluidity at any given temperature, and for that reason he continued to add it, not from any point of view of the presence of deoxidation products.

Impact Value and Zirconium

MR. BIERS, in reply, said that the question of zirconium in high-speed steels was another point where they could go into a great deal of detail. There, they had not only the matter of segregations, but also the related general effect of zirconium in improving impact strength as shown by the Izod test. Perhaps high-speed steel while cutting might be considered as being subjected to an infinite number of successive hammer blows. The marked decrease of all segregation was a characteristic of zirconium. This also applied to other steels as, for example, to medium-manganese structural steels. A steel with 1½ per cent. manganese and 0.25 per cent. carbon, treated with zirconium, would show an improvement of impact strength of 20 per cent. to 50 per cent.

As to why they apparently got better surfaces with calcium-manganese-silicon than with calcium-silicon, he should imagine that they could get just as good surfaces with the latter if it were possible to use that alloy with the same reliability as calcium-manganese-silicon. One must not forget that its physical state, merely from the point of view of specific gravity alone, was very unfavourable. Calcium-silicon, or calcium-silicide, was a very light alloy. When added to molten metal there was quite a pleasing little pyrotechnic display, due to the calcium burning off. If one could reliably get as much calcium into the metal with calcium-silicon as with calcium-manganese-silicon, he thought they would probably get the same result. Because calcium-manganese-silicon was much heavier, it penetrated the slag better and went into the metal.

Specific Gravity

MR. TUCKER said his experience was that calcium-manganese-silicon definitely tended to float on the surface of the metal, and they had to keep pushing it down in order to get the same good from it that they got out of calcium silicide. The surface of the castings, although cast in dry sand, was better, but he always put that down to the better fluidity. He did not know whether there was a connection between the two.

MR. BIERS said they were talking about a subject which must be discussed with great circumspection. He could not answer Mr. Tucker's point since he was using a deoxidising agent, calcium-manganese-silicon, to improve the fluidity and improve the surfaces, not as a deoxidising agent.

DR. R. J. SARJANT said that in the subject of deoxidation there were aspects of the problem which were more remote than the mere adding of deoxidants to give liquid products which would rise to the surface and give a clarified steel. In the first place what was the effect of "stewing" the steel? In the literature on the subject there were Papers which indicated that this had a definite effect on the crystalline condition of the steel when it had cooled. It was known that under suitable deoxidation conditions a high grade of steel could be obtained, even though it were maintained in the bath for a considerable period. What was the effect, however, when the ideal conditions could not be obtained? Was the final addition of the deoxidant equally effective in these two cases? The impurities which segregated in the grain boundaries were now receiving considerable attention. He referred in particular to the grain-boundary impurity mentioned by Tammann as the "between substance" which was responsible for a number of troubles met with in steelmaking. It was, of course, always necessary to distinguish between the effect of sulphur and phosphorus, particularly of the sulphur, and the ordinary mineral-slag inclusions which were in most cases the products of deoxidation. There had been much controversy in regard to the applicability of the work relating to the ideal manganese-silicon ratios which should be used in deoxidation. It would be interesting to have Mr. Biers' views on these aspects of the problem.

Grain Size

Continuing his remarks, the speaker said in regard to the question of grain-size control

he believed that the FeO content of the steel prior to the addition of the deoxidants was a critical factor in the determination of grain size. Each deoxidant according to the nature of its resultant product when added to the molten steel gave a specific relationship in regard to the grain size obtainable for any initial content of FeO in the steel at the time of adding the deoxidant. The most deoxidised steel gave the coarsest grain. As the FeO content in the steel increased, the grain size obtainable then became decreased under comparable conditions. Higher contents of FeO caused the relation to change and increase of FeO contents resulted again in the production of coarser grained steel. When, however, one considered the extensive claims which were made for various deoxidants and compared them with the actual practice operated in various parts of the world, the position from the scientific standpoint appeared to be somewhat confused, and he had the temerity to suggest that in the absence of more precise knowledge the use of specific deoxidants could become merely a "fashion." The real difficulty, he thought, was to be found in the varying character of the steel before the deoxidants were added. The best means of obtaining information on this subject whilst the steel was still in the furnace was one of the major problems confronting those who were undertaking the scientific study of steelmaking.

In regard to fluidity he believed that differences in fluidity in some cases, as judged by visual appearance of the molten metal, were likely to be misleading if a true knowledge of the temperature at the time was not available. It was possible to have a steel of good fluidity which appeared to be cold. The steel was not necessarily cold, but variations of emissivity could give an entirely false impression of the true temperature of the steel. One heard frequently of specific effects either in producing fluidity or sluggishness which were ascribed to special deoxidants. Until they had true knowledge of the temperature of the steel they could not distinguish between changes which were due to emissivity and those due to the inherent fluidity of the steel.

Practical Aspect Stressed

Mr. Biers said he quite agreed that they could make excellent steel without using any deoxidisers, but in talking about deoxidisers he was trying to do so from a practical point of view, and one which was of great importance to them to-day, namely, how could they make use of deoxidisers to get the steel into the moulds as quickly as possible. He knew that they could drag out the refining period; Dr. Sarjant knew, for example, that if they made successive very small additions of manganese, and made their additions of other elements so that they displaced the tendency toward equilibrium as little as possible with each addition, this helped them to make very clean steel, but all that took a great deal of time. The idea of talking about deoxidation in a practical way was to make some of them think about questions like this from deoxidising. It had just been mentioned that calcium gave coarse grain. Certain steels, wanted for deep-hardening purposes, were always made in acid furnaces because they were coarse-grained due to the silicon—would it not perhaps be possible to make a coarse-grained steel, rapidly melted in a basic furnace, by using calcium, getting the same results and increasing their rate of production? That was the type of idea that he wanted to suggest from a discussion of the practical use of deoxidisers.

Dr. Sarjant asked the author to explain that point a little further. Was it possible to produce a coarse-grained steel by means of calcium from any class of steel, assuming a certain condition of the steel before one added the calcium?

Mr. Biers said that was his next point. It was, of course, very important and was, he thought, the kernel of the position. Work with deoxidisers was only instructive if they knew where their effect started, and one of the valuable things that they had learnt from silicon and manganese was how these elements could be used and how they could be effective over the widest ranges of iron-oxide contents in creating an initial state of cleanliness and oxygen content in the bath, from which one could go forward. Naturally, if they were going to reduce the carbon content by alternately adding some ore, and then heat, and then ore, and then more heat, and make a guess at where they were (with respect to state of oxidation and cleanliness) when the carbon reached the desired value, they would not be able to do this relatively refined work. If they were doing any grain control he did not think it was possible to over-emphasise the importance of setting up the same starting point, and he thought the silico-manganese treatment was the best way of establishing an initial state as a starting point. Regarding Sims's and Dahle's work, there they had another point which had come up frequently. A parallel idea was the objection that some people had to silicon, for example, in some kinds of tube steel. Tube mills said "We shall not have any silicon." What they meant was "We shall not have any silicates," because under the steel-manufacturing method the addition of silicon at some particular time produced silicates. As a parallel it might be that under the method of Sims and Dahle their addition of aluminium produced dissolved aluminium and not alumina. One did not know; one could not compare, for they had no standard of creating an initial state for comparative purposes. As to fluidity, he entirely agreed with Dr. Sarjant. He had made spiral tests on steels which were considered to be cold, and they showed very much greater fluidity on test. These were covered with a scum, which was not transparent, but they really were more fluid although they appeared to be cold.

A Verdict on Aluminium

Mr. D. A. Oliver said the use of aluminium as a final deoxidiser was a thorny subject. He had come to the conclusion that aluminium had some virtues if they knew how to exploit them. A very small amount of aluminium would often ensure that the steel set densely and quite solid; it would not affect, within measurable limits, the machining properties of the steel; and they might gain in the process quite a reasonable improvement in the condition of the ingot skins. But if the quantity was increased, then, as they had heard that evening, they got very hard inclusions; they got combinations of alumina and silica and any free FeO or MnO that was present together with sulphides, and that type of inclusion gave rise to some of the worries that could be met with in quality steels, and one naturally turned away from aluminium from that standpoint. If, as had been stressed that evening, an initial state of deoxidation was established, then these other deoxidisers could be used with considerable advantage, providing very careful note was taken of the quantity to add.

Mr. R. Staton asked what was the particularly beneficial effect of zirconium. He took it that Mr. Biers was speaking of a high-sulphur machining steel.

Mr. Biers said the zirconium was more effective than manganese in fixing the sulphur in a malleable inclusion which could readily be forged and rolled.

Mr. Staton said the reason he asked was that he had seen a steel with very high sulphur and no zirconium at all, in which he knew that the sulphide was definitely at the grain boundaries in the cast condition, and there was not the slightest difficulty in forging it.

Mr. Biers said he did not allude to steel of that type. What he meant to say was that the effect of zirconium was such that steels containing no manganese could be successfully forged and rolled if they contained zirconium with the normal amounts of sulphur. Replying to another member, Mr. Biers said he had found the sulphur very much more evenly distributed in the presence of zirconium, and also very much more evenly divided. This was so even in a rimming steel, although undoubtedly in that case the addition of zirconium must be very small. In Germany he had seen a basic steel of rimming type, manufactured in converters, in which the zirconium addition was as small as 0.03 per cent.; there was no residue, but it did affect the sulphur distribution. He did not know why. It did not seem logical at first glance, but it happened.

Sluggishness

Dr. Sarjant said he would not like to venture any opinion about a broad view of sluggishness. He knew that people talked about sluggishness in steel, and they sometimes judged it from the teeming speed, and he had frequently heard it said that zirconium made the steel sluggish, or aluminium made it sluggish. Under certain conditions a steel might run sluggishly, but he thought this was probably due to some other factor than the inherent fluidity of the steel. For example, the speed at which steel ran was governed by the teemer and the way in which the nozzle worked, and there were other factors, such as how much steel there was in the ladle, and whether one was talking about the first ingot, the second or the third. The speed at which a ladle ran would gradually increase up to a certain point, and then it would begin to fall off as the ferrostatic head dropped. It was a most difficult matter to try to work the problem down to any certain definite law. They could see the general nature of the flow, but to try to track down the dozens of factors which were operating, and to say exactly how much effect each one had, was a formidable problem.

Mr. Biers said he could give one specific instance of the confusion that was likely to arise. Zirconium-treated nickel steels were frequently contended to be sluggish, but it had been discovered that for some reason or other the nozzle built up, and if they used a nozzle of one size larger this steel was no longer sluggish. In answer to Mr. Tucker, he said he did not know whether that meant that they got less refractory inclusions in the steel. Replying to Mr. Stanfield, he could not say what caused the nozzle to build up. The peculiar thing was that the effect mentioned only happened with nickel steels, so far as he knew. It was fairly easy to confirm. He had had experience with them in several countries.

Zirconium Losses

Mr. E. J. Brown asked what was the efficiency of an addition of zirconium when it was added to the stream in tapping. His experience was that zirconium got involved in a highly-refractory slag and they lost the major portion of it.

Mr. Biers said that again would depend a great deal on what they wanted to do. In general, as far as one could make any generalisation, he would like to mention two zirconium alloys. Except in cases where they were making the addition for some specific purpose, as for example, in a free-cutting steel where they wanted residual zirconium, 0.15 per cent. appeared to be the maximum addition. In an acid melt, where they were already running very low oxygen and where they had been carrying silicon through the metal most of the time, they could get a very beneficial result from 0.03 per cent. or even less. This was presuming, of course, that they had established some initial state to start from. As they would judge from an acid melt there was a lot of silicon present, namely, enough to react simultaneously with the zirconium and give the desired low-melting silicates; the alloy 40 per cent. Zr + 45 per cent. Si might therefore be the most useful in acid practice. In a basic melt, 14 per cent. Zr + 40 per cent. Si was frequently most useful. This was about all the generality that he could give them.

Dr. Sarjant said that he should think that to add zirconium silicide to a furnace would not be really giving it a fair chance.

Mr. Biers said he agreed, but in some cases it was an advantage. For some types of steel—on remelting jobs, for example—where they had a tendency to pick up nitrogen, powdered zirconium silicide instead of finely-divided ferro-silicon, added to thin the slag in the furnace, would cut the nitrogen content very much. In fact, if a sample of the slag were examined it would be full of the yellow cubes of zirconium nitride. On a chrome steel, if they kept on adding the alloy (the slag would be kept a light green), and in the end they would cut down the nitrogen considerably. These matters, however, were away from the question of deoxidisers, as they were using the elements for other purposes.

One further point he would like to mention about silico-manganese practice was that it was generally accompanied by particularly good manganese recoveries. The over-all manganese recovery on the melts of which inclusion counts were shown was 74 per cent.

Magnesite and Chrome Ore Imports

The Board of Trade have issued the Import of Goods (Prohibition) (No. 16) Order, 1940, adding (1) natural or artificial magnesium carbonates, hydroxides and oxides, and dolomite and mixtures wholly or mainly thereof, with or without water; and (2) chromium ores and concentrates, whether briquetted or not, to those subject to the import licensing regulations.

The Order came into operation on April 17, its object being to supplement the Control Order recently made by the Minister of Supply for the purpose of regulating the sale and purchase of these materials.

Production of Some Engineering Castings

By A. MARSHALL

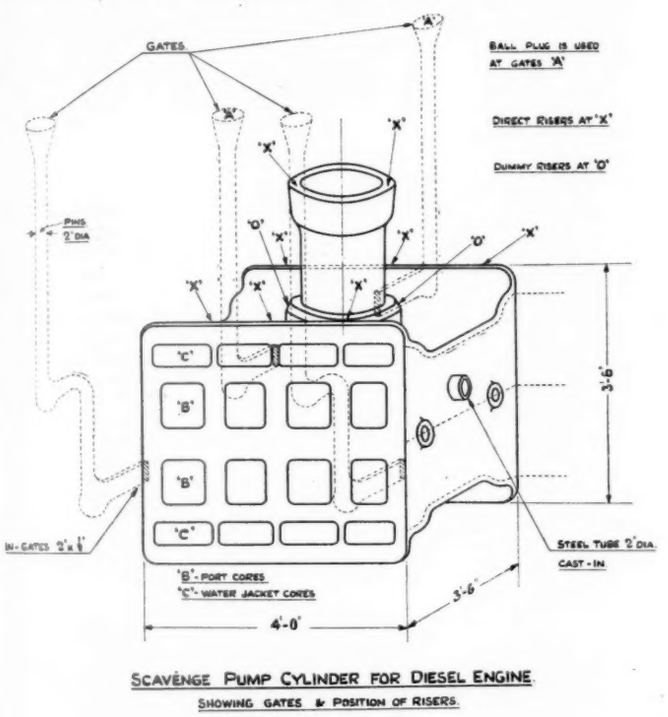
(*Continued from page* 291.)

SCAVENGE PUMP CYLINDER FOR DIESEL ENGINE

Fig. 14 shows a sketch of a Diesel scavenge pump cylinder, and, as in the steam cylinder, machined faces are everywhere. The mould is reasonably plain and is made in dry sand, the cores being made in oil sand. The design of this cylinder may classify it as a core assembly job. Partings are made at the points indicated, and a combination of top and bottom runners is used here also, plugs being used on the down runners. When the mould is half-filled the top runner plugs are released.

The flange around the spigot has a bead cut round the outer edge to assist in taking away any particles of dirt that may find their way into this area. Chills are used at the junction of the heavy and light sections. Drying, venting and hot metal again play important parts in the successful production of this type of casting.

The gates were situated at the bottom and entered the mould along the slide face. Risers were taken off at the stool faces—four on each end—in two of which rod feeding took place directly above the bosses carrying the main drive. The diameter of the risers is about 2½ in. It is impressed on the man feeding the casting that he must go down into the casting with the feeding rod and keep pumping at that depth, not raising the feeding rod until the metal is solid below the rod. Fresh metal is added at intervals, and while one must admit that this is an exhausting operation, premature withdrawal of the rod will show its results in the nature of a hole directly underneath the riser.



SCAVENGE PUMP CYLINDER FOR DIESEL ENGINE
SHOWING GATES & POSITION OF RISERS.

FIG. 14.

MACHINE-TOOL PRESS HEAD

Fig. 15 depicts a machine bed weighing 2 tons 5 cwts. This casting had to meet a specification of 18 tons tensile and a Brinell of not less than 170 on the machined slides. The mould and cores were made in dry sand, the top cores being bolted to the bar provided in the top part. This allowed the cores to be "skin-dried" and fixed in position before the mould was passed into the stove for drying. By this method a large reduction in closing time was effected, and the actual closing operation consisted of placing in position, in the drag, the slide cores and main bearing cores, and any small cores attached to the facings. The top part was ready to be placed in position. The parting line can be followed in Fig. 15.

The faces of the stools were cast upwards and some dirt was shown on the surface, although it was not of great importance as this was the down side when the bed was erected. Nevertheless steps were taken to obviate this defect, and two dummy risers were taken off at each side of the facing. These, plus ¼ in. extra machining, making in all ⅜ in. machining allowance, cured the trouble. In the casting mentioned, densening has been applied, as a rule, on the wearing parts, particular care being taken to ensure that the chills were clean and dry. In this casting they are on the bottom side, and if possible kept clear of the runner in order to reduce the risk of burning-on. Oblong chills, about 4 in. long, are the type generally used, and their thickness is about 60 per cent. of the thickness of metal being densened. Some forty castings of this type have passed through the foundry, and all of them were entirely satisfactory.

Analysis:—T.C, 2.90; Si, 1.6; Mn, 0.70; S, 0.08 max., and P, 0.60 per cent.

MAIN COLUMN FOR SAW FRAME

Fig. 16 shows the front and rear view of the main columns of a large saw frame, the tubular section of which must be clean and free from defect. It may be considered, and rightly so, that the correct method of producing this casting would be to mould it in the horizontal position and turn it up on end for casting, with an allowance for the usual head metal. At the commencement of the manufacture of this type of casting, a combination of factors forced it to be moulded in the horizontal position, and to cast on a "bank" of approximately 10 deg. The main circular core, which is 14 in. dia., was swept in loam, mild steel bars being inserted at an equal distance from each end, and at the top and bottom side of the core. The bars are in the vertical position, one end bearing on the main core bar, and the other flush with the outside diameter of the core. This provision is necessary, as plugs are fixed in the mould to support and prevent lifting of the core during casting.

The supporting section core was made in dry sand; prints of liberal length were allowed for at the top circular end of the column, where 9-in. head metal was incorporated. The open side of the supporting section was moulded on the down side. This allowed the dry-sand core to be placed in position, and the main loam core located in the print provided in this core. The print is D-shaped, and is made up after coring is completed. It may be wise to stress the necessity of an accurate division of metal thickness, as this casting has to carry a considerable load, and the metal section has been cut down to the limit. The parting in a job of this type is relatively simple; it travels along the bottom side of the rounded edge of the box section and steps down to the centre of the tubular section.

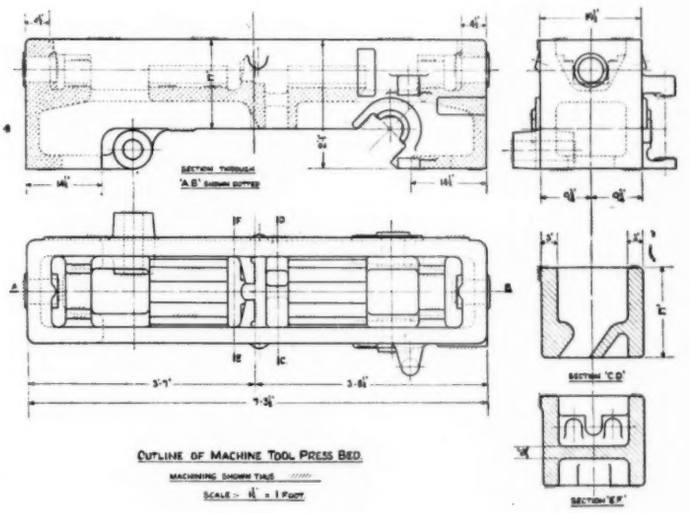

SECTION THROUGH 'A.B.' SHOWN DOTTED
SECTION 'C.D'
SECTION 'E.F'
OUTLINE OF MACHINE TOOL PRESS BED.
MACHINING SHOWN THUS
SCALE :- ½" = 1 FOOT

FIG. 15.

Gating took place at the box section, and two in-gates entered the mould along the thickness of metal, having a cross-section of about ¾ in. by 3 in. A deep pouring basin was, of course, necessary when casting at an incline, and a dirt-trap runner was used similar to that in the machine-tool bed previously described. A raised ridge was provided for, extending for a distance of about 3 ft. from the head end of the mould, rounded on the top edge, and about 2-in. by 1½-in. cross-section. It was thought that any particles of dirt, entering the mould and being washed through with the flow of metal, would find their way into this trap. After the first

casting was produced, this piece of metal was removed and machined, sawn into sections and examined thoroughly, and no trace of defect could be found. One riser was taken off at the circular end of the mould, and one at each corner of the box section. The vent was carried through to the top end for the loam core and through the bottom for the dry-sand core. The casting weighs 32 cwts. and is 20 ft. long.

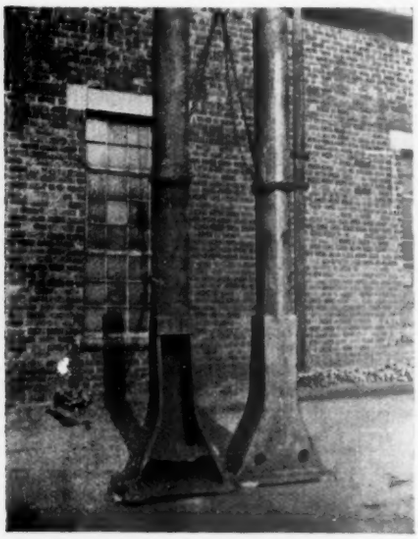


Fig. 16.—Main Columns of Saw Frame, Showing Front and Rear.

MAIN FRAME FOR LARGE SAW

The casting shown in Figs. 17 and 18 is made in green sand. The pattern is bedded in the foundry floor, and panels at suitable points on the pattern are made to lift out. This enables the moulder to ram the pockets and webbing, shown in the casting, with little difficulty. Core holes and pockets along the machined slides are cored out, oil-sand cores being used. The top-

Fig. 17.—Main Frame of Large Saw.

part moulding box is in two sections, each section being the part of a standard size box. This enables each part to be turned over easily, as these boxes are of the shallow type, no great depth being required for this frame in the top part. Making the top part in two sections reduces the risk of yield, which may mean the "starting" of the mould, and the patching of which very often results in sand dropping from the cope and being washed into the casting with the flow of metal.

In many frames of this description, it has been found necessary to introduce strengthening bars through the panels, this being a precaution against fracture of the casting during the cooling period, as in some of the designs heavy bosses and slide facings tend to prevent a uniform cooling rate.

Casting takes place from both ends, this being advisable, since the metal thickness is $\frac{1}{4}$ in. and the tendency for dull metal at either end must be avoided, as machined faces are situated there. The in-gates at the feet end of the casting enter the mould along the webs on each side, and the same method was adopted at the other end. The casting weighs 25 cwts., and is approximately 20 ft. long.

WOOD-TURNING LATHE BED

Fig. 19 shows the casting for a wood-turning lathe bed. The castings in this design weigh from 10 cwts. to 25 cwts., and are made in green sand. The cores consist of the bottom core, which cores out the distance between, and the thickness required for the slides. This core is made in two sections, and has the print forming the guide for the cores that shape the diagonal ribs. The gating takes place along the slide face. Two in-gates, and in some cases two small gates, are cut at opposite ends, and pouring from a 5-cwt. ladle takes place when it has been judged that the metal from the larger ladle has filled the mould to the level of the top of the main slide section. This ensures solidity on the fitting strips at the top end of the casting, since it can be quite readily seen that the metal is cooling during the process of filling the mould. Defects had been noticed in previous castings, due to dull metal at this point. The gap shown on the slide is a provision for turning face plate work of larger diameter.

MARINE ENGINE CASTINGS

Fig. 20 depicts a mould for a marine cylinder cover and is swept in dry sand. Many castings of this type are produced similar in design and with very satisfactory results. The method of gating can be clearly seen, twelve pencil gates striking the mould directly in the centre of the supporting ribs. Three risers are situated on the outside flange.

Fig. 21 shows a group of main engine castings, including medium- and low-pressure cylinders, soleplates, columns, pistons and cylinder covers with miscellaneous castings. All the large castings are made in dry sand. In the case of the soleplate, this is made in the pit. The centre portion between the bearings is lifted out and dried in the stove. The remainder of the mould is dried with portable dryers. Castings of this type may weigh from 50 cwts. to 6 tons, and are mounted and cast in the position shown in Fig. 21.

LIGHTER CASTINGS

It is now proposed to deal very briefly with a few types of castings which may be classified as light, that is from 1 lb. weight to 1 cwt. Here again a close study of production is essential, and a costing system that will give an accurate cost of each individual type of casting is indispensable. Those in control should be able to see at a glance the cost of producing each casting and the selling price. There are many systems in operation that will serve to give a fairly accurate return.

This point is mentioned because light castings in the general jobbing foundry are often taken at an overhead rate. This is not a satisfactory arrangement, as it may allow a considerable number of castings to be produced at a loss before the loss is discovered.

The following examples are all made in green sand.

Gear Guard and Pulleys

Fig. 22 is a typical example of a design of a gear guard, the castings weighing from 7 lbs. to 30 lbs. The mould is made complete in the drag half of the moulding box; the core is made in oil sand, and the gating arrangement can be clearly seen, four spray inlets at the wide side of the casting proving satisfactory. Quite a number of plain and stepped pulleys are produced by similar methods, gating taking place

Fig. 18.—Reverse Side of Main Frame shown in Fig. 17.

with a drop gate on the boss. Many thousands of these castings have been produced, both by hand and machine moulding, with abnormally small scrap losses.

Standard belt pulleys (Fig. 23) are made from metal patterns. Two designs—the solid centre web, and the spoke pulley—are continually in production, the sizes ranging from 6 to 30 in. diameter, the patterns of which leave their own core. All those pulleys are gated in the boss, and "whistlers" are cut in the top joint. The average thickness of the rim is about $\frac{3}{16}$ in., and the "whistlers" have been found of great assistance in helping to take away any trapped air in the rim, and they have become a standard practice in the production of all pulleys of this type.

In cases where the designer has called for an

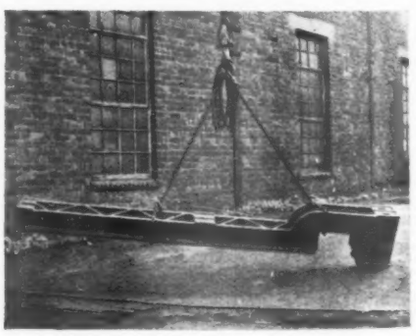


Fig. 19.—Casting for Bed of Wood-Turning Lathe.

exceptionally heavy centre boss, it has been considered advisable to turn the moulding box on its side and bare the boss of sand. This has the effect of balancing the cooling rate between the lighter section of the arms and the boss, thus reducing the risk of wasters due to the fracture of the casting through the arms. Large quantities of these castings are being produced yearly, and over five years defectives returned from

the machine shop show an average figure of 0.5 per cent.

Examples of other castings produced under this group include gear blanks, liners, valve bodies, gear mountings, cams, etc. The liners are moulded and cast in the perpendicular position, the ingate entering the mould tangentially, giving a spinning action to the metal as it is filling the mould. Strainer cores are used in the bushes. The small liners in green sand are remarkably free from dirt inclusions.

In a number of the other castings, top runners are incorporated with satisfactory results. All castings are cast at fairly high temperatures, as 90 per cent. of them are machined all over.

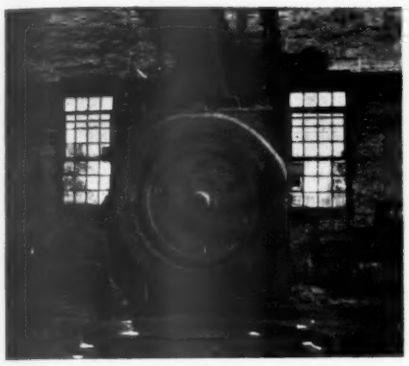


FIG. 20.—DRY-SAND MOULD FOR MARINE CYLINDER COVER.

In summing up, the words of C. H. Lorig in "Grey Iron Metallurgical Practice"* may well be quoted: "After all, properties of castings should be looked upon from the point of view of the engineer or customer and hence castings should be provided with such qualities as make them satisfactory for the intended service and should not be merely made to satisfy some arbitrarily imposed physical test standard."

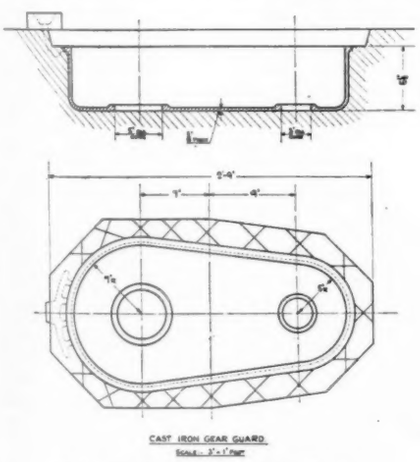


FIG. 22.—DESIGN FOR GEAR GUARD.

In conclusion, the author wishes to record his indebtedness to the directors of Thomas White & Sons, Limited, Paisley, for permission to publish this Paper and for the use of the company's equipment and material.

DISCUSSION BY SCOTTISH BRANCH

When the Paper was presented to the Scottish Branch of the Institute of British Foundrymen in Glasgow, the BRANCH-PRESIDENT (Mr. N. A. W. Erskine) said that the author was to be congratulated on the Paper, both from its interest and from the clear and concise description of the methods. Referring to the photograph of the casting (Fig. 14) showing 12 down-gates, Mr. Erskine wondered if the number and size of the gates were calculated to give a definite speed of pouring. Secondly, he noticed the very close analysis the author attempted to get. Was he right in assuming that Mr. Marshall was making a variety of mixtures?

MR. MARSHALL replied that he calculated the sizes of the gates for a definite pouring rate. The Diesel cover referred to was poured in 40 secs. with metal as hot as possible—1,320 deg. C. approximately. He did get a variation of analysis because of the variety of castings. While he did not like to have too many mixes, he tried to satisfy the customer.

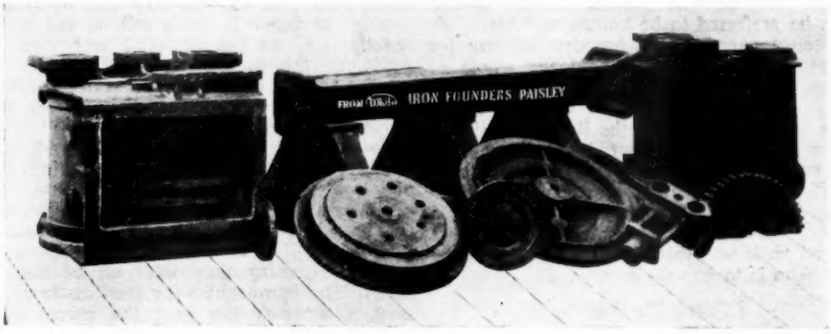


FIG. 21.—GROUP OF MAIN ENGINE CASTINGS, INCLUDING CYLINDERS (MEDIUM AND LOW PRESSURE), SOLEPLATES, COLUMNS, PISTONS AND CYLINDER COVERS.

MR. CRAIG referred to his association with Mr. Marshall's firm during the period of his apprenticeship and confessed to having seen very few defective castings. He recalled the very high speed of the machines which were made by the firm and which called for the best of material and finish.

MR. J. E. O. LITTLE asked about Fig. 4, showing the bed with eight cores, four of them made in dry sand and four in green sand. He thought it was risky to use green-sand cores in such a job and that it would have been just as cheap to have dried them all.

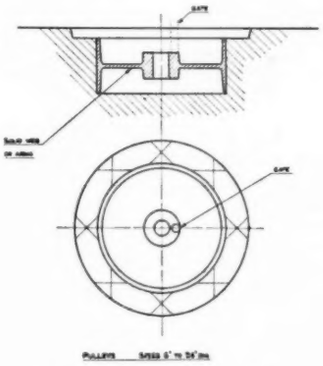


FIG. 23.—DESIGN FOR BELT PULLEYS.

MR. MARSHALL explained that he had to consider the stove capacity. He would have made all the cores in green sand, but as the metal was running over them continuously he thought it better to make the first two in dry sand.

The BRANCH-PRESIDENT said that the Paper had been of great interest and no doubt of great benefit to many members. He asked them to accord their thanks to Mr. Marshall.

The AUTHOR, replying, said that no one ever reached the limits of possibilities in a given field of endeavour, because the initiative which embraced the opportunities of to-day also constantly unfolded those of to-morrow.

* "The Foundry," March, 1939.

Institute of British Foundrymen

PAPERS LISTED FOR ANNUAL CONFERENCE AT CHELTENHAM

The following are the Papers which have been announced for presentation at the Annual Conference of the Institute of British Foundrymen at Cheltenham on the morning of Saturday, June 8. Two simultaneous sessions will be held, both of them in the Town Hall.

SESSION A.

"The Present Position of Heat-Resisting, Corrosion-Resisting and Wear-Resisting Cast Irons," by R. C. Tucker, M.A. (Member) (Newton Chambers & Company, Limited, Sheffield).

"The Production of Pressure-Resisting and High-Duty Iron Castings," by J. L. Francis (Member) (Reavell & Company, Limited, Ipswich).

"On Developments in Gating and Risering for High-Shrinkage Alloys in High-Test Cast Iron," by A. E. Cartwright and C. C. Brisbois (Robert Mitchell Company, St. Laurent, Quebec). *Exchange Paper presented on behalf of the American Foundrymen's Association.*

"The Extended Use of Cast Iron with Special Reference to War Conditions," by J. G. Pearce, M.Sc., M.I.E.E., M.I.Mech.E., F.Inst.P. (Member) (Director, British Cast Iron Research Association).

SESSION B.

"The Design of Test-Pieces for Carbon Steel Castings," by C. H. Kain and E. W. Dowson (Members) (Lake & Elliot, Limited, Braintree).

"Gases in Cast Iron," by W. Y. Buchanan (Member) (J. Lang & Company, Limited, Johnstone).

"Observations on Contraction in Cast Iron," by E. Longden (Member) (Craven Bros., Limited, Manchester).

As already announced in the JOURNAL, the Conference will be held at Cheltenham on Friday evening, June 7, and Saturday, June 8. A dinner followed by dancing is to be held on the Saturday evening.

Contracts Open

Chester, May 4—Construction of approx. 7½ miles of cast-iron water mains varying from 7 in. to 2 in. dia., and incidental works, for the Tattenhall waterworks scheme, for the Tarvin Rural District Council. The Engineer, Westminster Buildings, Newgate Street, Chester.

Hucknall, April 30—Cast-iron pipes from May 1, 1940, to March 31, 1941, for the Urban District Council. The Surveyor, Council Offices, Hucknall, Notts.

Johannesburg, May 6—Eleven 4-ton level-luffing electric portal travelling wharf cranes, for the South African Railways and Harbours Administration. (D.O.T. reference: T. 17,640/40.)

The Merchandising of Castings

USEFUL DISCUSSION IN LONDON

The subject of selling occupied the minds of members of the London Branch of the Institute of British Foundrymen when Mr. R. B. Templeton presented to them a Paper on "The Merchandising of Castings" (published in our last two issues).

The BRANCH-PRESIDENT (Mr. Barrington Hooper, C.B.E.), inviting Mr. Templeton (who is Junior Vice-President) to present his Paper, commented that, although the lecturer had attained the rank of captain in the British Army, he preferred to be known as "Mr." He had been engaged in the foundry industry for only ten years, and throughout the whole of that period he had been a member of the Institute.

This country, continued the Branch-President, could manufacture all that it could sell; its main problem was to sell everything it could manufacture. Any man who could help to achieve that end, therefore, was rendering a very real service to the country; if wars were won and trade was lost, the question that arose was, "Who is to pay the cost?"

Group Publicity

The Branch-President said that selling was his particular interest, and he had hoped to have been able to deal with the subject from a personal point of view in his Presidential Address to the Branch; but the arrangements for the opening meeting of the session, at which that address would have been delivered, had had to be cancelled because of the outbreak of war.

Group advertising or group publicity, which had been mentioned in Mr. Templeton's Paper, was a fundamental in selling; it was so much easier to sell goods in a market in which the desire for them had been created by group publicity than in a market in which a group appeal had not been made. It was necessary, however, to understand the functions of collective or group selling and the functions of individual selling. The function of the group publicity was to create the demand. In the case of cast iron, it was to create in the minds of the purchasing agents the firm belief that grey castings were best—just as the various interests had impressed upon the public that "Beer is Best," that bread created energy, and so on.

When the purchasing agents had been convinced by a group appeal that cast iron was best, it was the function of the individual salesman to satisfy the demand, and it became easier for him to show why his particular form of casting was desirable than it would be without the aid of the group appeal. Thus, group advertising was essential, but it was neither exhaustive nor complete; it was merely a tilling of the soil preparatory to the harvesting, and the harvesting must be done by individual selling.

Relative Selling Prices

MR. C. H. KAIN (Past Branch-President) congratulated Mr. Templeton upon his Paper and the manner of its presentation. It was not often, he said, that Mr. Templeton addressed the members of the Institute, but when he did he set a very high standard.

Perhaps the title of the Paper might more correctly have been "The Merchandising of *Iron* Castings" rather than "The Merchandising of Castings." Discussions on canvassing or selling usually had a very strong cast-iron bias; and the Branch-President had referred to a collective appeal to make the buyer "iron-casting minded." There were, however, various non-ferrous castings and steel castings. As one who had to make castings in grey iron and in steel, Mr. Kain endorsed very strongly most of Mr. Templeton's remarks, and added that the Branch was very fortunate in having a member who had given so much thought to the subject of selling castings.

One felt that in the past the foundry industry had to a very large extent sold its products on price alone, and that it was only as the result of the work of gentlemen of the calibre of Mr. Templeton that the industry was approaching a stage at which it could sell on the basis of quality, *i.e.*, on the basis of real value—and many of the products of the foundry were worth more than 19s. 6d. per cwt., which was the price that seemed to stick in the minds of some buyers!

As a maker of steel castings, and having had experience in the past of making malleable-iron castings, Mr. Kain said that in the chart exhibited by Mr. Templeton the relative selling prices of cast iron, high-duty cast iron and malleable cast iron were approximately correct, assuming they were all of the same class. The figure given for steel castings, however, was much too low; the current prices of steel castings were low enough in all conscience, but they were appreciably above the figure given in the chart.

After commenting that Mr. Templeton's analysis of the general attitude of the buyer and the engineer was masterly, Mr. Kain urged that the problem of educating buyers by means of group publicity was one to which the foundry industry must give very serious thought. An outstanding instance of such publicity was that of the nickel group, and the average engineering buyer had become definitely nickel-minded. But iron foundries and steel foundries were receiving inquiries for their nickel-iron or nickel-steel castings, and frequently those inquiries did not indicate precisely what was wanted. When the founders wrote in response to those inquiries and asked the prospective customers just what they required, the latter would reply to the effect that they did not know exactly, but they wanted nickel iron or nickel steel, as the case might be; often the buyers had not the faintest idea as to what they required.

Test Result Interpretation

With regard to the suggestion in the Paper that the hardness and tensile relationship was reliable in steel but was unreliable in cast iron, he assured Mr. Templeton that the habit of engineers in assessing the tensile strength of a steel casting from its Brinell hardness was equally unreliable as it was in the case of a grey iron casting. Further, speaking as Convener of the Steel Castings Sub-Committee of the Institute's Technical Committee, he said that the Sub-Committee was not prepared to admit that the Izod impact test was quite suitable for steel castings, using the 10-mm. ball. Undoubtedly, he said, the impact test had a great future; but the results obtained in the application of that test so far to steels, and particularly cast steels, were in some cases so very contradictory that the Sub-Committee was not prepared to accept that test without very considerable reservation. Eventually a suitable impact test would be evolved, but it had by no means reached finality yet; it was the subject of careful investigation at present.

The Yield-Point Basis

Although Mr. Templeton had exhibited great insight in his references to the yield-point evaluation of castings, particularly in the case of the ferrous metals, it must be remembered that the maximum stress value was still the criterion of acceptance. Mr. Kain said he had suggested to a number of inspecting engineers that the yield point was the real criterion of value. At present the engineers were not prepared to accept the yield-point evaluation, therefore, the maximum stress was still the vital factor to be borne in mind when selling castings.

Whilst he agreed with Mr. Templeton's fatigue strength figures as being fairly reliable, he was not prepared to agree that a notched bar representing a steel casting would break if it received a smart tap, whereas considerable energy was required to break a rod representing an iron casting!

The Paper by Mr. Templeton was particularly interesting at the present juncture, because Dr. S. F. Dorey had recently published a Paper, which was reviewed editorially in THE FOUNDRY TRADE JOURNAL, on the relative values of castings and welded structures, and had handed the palm to iron castings in respect of their damping capacity; Dr. Dorey had stated that undoubtedly there were considerable fields in which the use of cast iron would never be superseded by any form of steel.

The suggestion by Mr. Templeton, that it was better to have two scrapped castings in the foundry than one in the customer's machine shop, was very sound. Indeed, it was better to have 25 per cent. scrap in the foundry than to risk having 2 or 3 per cent. returns from the customer.

Emphasising the point made in the Paper that the foundries must give service to their customers, he said he was afraid that in the past the grey-iron foundry industry had been thinking merely in terms of tonnage and output and had neglected service to the customers. Undoubtedly in the future the foundries must really give service.

Finally, he urged the great importance of soundness in castings, and said that perhaps Mr. Templeton had not stressed that sufficiently. A sound casting in an inferior material was better than a possibly unsound casting in a superior material.

Appeals to the Public

MR. C. C. BOOTH, J.P. (Past Branch-President), thanked Mr. Templeton for the good work he had done and was still doing for the benefit of the whole trade. With regard to collective advertising on behalf of the trade, he urged that the need was to direct it not so much to the purchasing agents in the industries already using iron castings as to the public and other industries and trades which were not yet using them, in order to prove the value of iron castings to those industries and trades and so create a wider demand.

The castings produced by Mr. Templeton had come on to the market at first in a small way, but the demand had greatly increased owing to the propaganda, and the industry as a whole should unite to increase further the use of iron castings.

Avoiding Internal Stresses

MR. V. C. FAULKNER (Past-President of the Institute) said he considered that the good name of castings had been damaged in the engineering world more by the existence of internal stresses in the castings than by any other single factor. As an example, he recalled a recent case in the Courts concerning the cracking of several castings, it being alleged that cracking had occurred in the machine shop, on the delivery lorry and during fettling. Obviously, he said, the castings were of complicated sections, and stresses were locked up within them. In that connection he drew attention to the requirement of the French Admiralty Specification, that all castings must be heated to a temperature of not less than 500 deg. C. and not more than 600 deg. C. before delivery; and he urged that if

foundries, and particularly the jobbing foundries, which were producing large castings, would follow that rule, the good name of castings would be enhanced in the engineering world.

Factor of Friendship

Emphasising the importance of the psychology of selling, he recalled that Mr. J. W. Gardom had on one occasion pointed out that it might be a good thing for every foundry to have two salesmen calling on each purchasing agent, because differences in temperament as between the two salesmen might have great influence on the various purchasing agents. It had occasionally been found that one traveller had called on a firm for years and had never obtained an order, whereas another traveller would obtain an order on his first call. It was necessary to find out how it was that one traveller would do well in certain cases whereas another would not.

Such factors influenced not only local trade, but overseas trade also. If statistics of cast-iron pipe sales in three South American countries were examined it would be found that in one of them Great Britain obtained all the orders, in another France would get all the orders, and in a third the sales had been divided between Great Britain, France and Germany. There must be some reasons for that. It was not just a question of price and delivery; somebody had made valuable friendships. However good the materials one had to offer, friendship was and would always remain one of the major factors in selling.

Recording Failures

MR. E. H. BROWN said that for a long time past he had heard many people pay compliments to Mr. Templeton in respect of his ability to impress upon engineers the important qualities of iron castings; and one wondered how many salesmen in the industry were so capable in stressing the good points of their products to others. Such ability was of the greatest importance, and it was for all firms to attain the same standard as Mr. Templeton had achieved. The Institute was definitely working towards such ideals. Only a true foundry engineer could sell foundry products successfully, and probably in the future there would be an increasing demand for such men to sell foundry products.

Emphasising that founders, engineers and others would do well to tabulate their failures, Mr. Brown said that only that day he had visited a firm which had tabulated particulars of failures in connection with no fewer than 16 different products, and had noted in each case the steps that were taken to counteract the troubles experienced. He suggested that few firms took the trouble to do that.

Continuous improvement in their products was an essential in expanding the businesses of founders. In that connection he pointed out to Mr. Kain that engineers were appreciating more and more how much they were concerned with the yield point, as compared with the maximum stress, of their material, and he suggested that, with a little more persuasion, the yield point as a criterion would come to the front.

MR. V. DELPORT (Past Branch-President), stressing the importance of technical knowledge on the part of a salesman, said that over a period of years he had met a number of salesmen and buyers who did not know very much about the products they were buying or selling. A buyer or salesman should not be entirely a commercial man, but should have some knowledge of the technicalities of his products in addition to his commercial ability; he should graduate through the works, in order that he should have the opportunity to learn all he needed to know about his products.

MR. S. B. KENT said he had found it to be a great help, in the selling of castings, to send not only the salesman but also the foundry manager, or even the patternmaker, to see the prospective customer. Such men could put the project so clearly into the mind of the prospective customer that he had not the heart to refuse the order!

MR. KAIN made it clear that when he had referred to the relative merits of yield point and maximum stress in castings he was not necessarily advocating that castings should be bought and sold on the criterion of the yield point; he was merely pointing out that the maximum stress was still the acceptance criterion.

Qualities of Salesmanship

MR. A. S. BEECH (Past Branch-President), speaking as one who had been engaged in selling during the last thirty years, suggested that it was necessary to educate buyers as well as salesmen. In his experience the four essentials in selling were: (1) To offer a good article; (2) to secure the confidence of the customer; (3) the salesman must really know what he was talking about, so that he was able to relate his story convincingly; and (4) when a trial order was secured, the salesman must be able to ensure that the customer received proper value. Quality would always tell. If one gave the customer value in the first place, and if he were a straightforward buyer who really wished to obtain the best, one would have no difficulty in selling a second time.

The qualities required in a good salesman were great. Some years ago a man who held a very important position in the iron foundry industry had said that, whereas he could obtain the services of any number of technical men, it was a very difficult proposition to find a good salesman. A good salesman must be born with the necessary qualities; he must know how to study his customers' needs, he must know their characteristics and must know how to expound in each case the potentialities of the products he had to offer.

AUTHOR'S REPLY

MR. TEMPLETON, replying to the discussion, agreed with the Branch-President that group publicity was essential, and said he could see no other way of creating a demand than by hammering continuously into the minds of prospective buyers the information which that publicity imparted. He believed that statistics prepared some time ago had shown that, if an advertisement were published in a journal on one day, 50 per cent. of the people who had read it would have forgotten all about it by 10 a.m. on the next day, and by 4 p.m. on that day a further 20 per cent. would have forgotten about it; and on the following (or third) day probably the remainder would have forgotten. Those statistics were prepared to show that advertising was definitely a matter of keeping the advertised commodities before prospective buyers continuously. He could see no better way than by advertising in the most suitable journals, because in time those journals represented a certain selling market, of which the buyer was aware, and he read them because he knew he would get the required information there.

Group advertising might be very difficult for foundries making miscellaneous castings in London, but it might be possible for a number of such foundries to form an advertising group, each sharing the costs by contributing an agreed amount periodically, and to advertise in journals which were read by production engineers and engineers generally. Whether or not that scheme could be adopted he was not prepared to say. His company was connected with a group of foundries for advertising purposes, and the cost to each participant was very modest. Their illustrated pamphlets were, in his opinion, very effective; their cost, when printed in fairly large quantities, was about 2d. each. Such a pamphlet would be kept by the engineer or buyer, and the names of the advertisers were thus always before him. Advertising certainly represented three-fifths of the work of securing an order, and the salesman ought to be able to do the other two-fifths quite easily.

Agreeing with Mr. Kain that the foundry industry had in the past based its selling on price, which policy was wrong, he urged that founders should now try to co-operate with each other and to abandon that policy, for he was sure that it never did anyone any good. He was very glad to know that his estimate of the selling price of cast steel was low.

It was true that the nickel interests advertised very well. He had heard of a case recently in which a founder, who was making iron containing 1.4 per cent. phosphorus, was told that it would be satisfactory if he added 1 per cent. of nickel. He might just as well have added fruit salts as to have added nickel to a 1.4 per cent. phosphorus iron.

Impact Strength

He had not meant to convey that the standard Izod impact test was altogether suitable for cast steel. When he had mentioned that test he had intended to refer to its use on mild steel, not cast steel.

MR. KAIN said he did not know that any steelmaker was prepared to accept the Izod test result as a criterion.

MR. TEMPLETON agreed with Mr. Kain's remarks about the importance of giving service to the buyers to ensure that they were satisfied. The breaking of castings during transit, mentioned by Mr. Faulkner, might have been due entirely to faulty design, or might have been due largely to faulty casting methods. If a design were faulty, such as the linking up of thick and thin sections, it would probably give rise to trouble. In such cases the foundryman should suggest to the engineer that the casting would not be sound and should try to persuade him to modify the design, or should refuse to make the casting.

The idea of having two salesmen calling on one customer was excellent. It might happen that the first salesman would call on a customer at intervals over a period of two or three years, without success, and then the second salesman would call when the customer was in a good mood and would obtain an order, and he might secure it as the result of two or three years of intensive work by the first salesman.

Replying to Mr. Brown's complimentary remarks on his abilities as a salesman, Mr. Templeton said that if he had any abilities in that direction it was perhaps because he was selling a specialised product. In selling a speciality, one was on a rather easy wicket, *i.e.*, in a better position than a man who was selling something which everybody else was selling; customers were more inclined to listen to a salesman who was offering a specialised product.

Service Records

The point made with regard to service records was very sound. His own firm compiled service records of good castings, but were more insistent about keeping records of castings which had failed and finding out the reasons for the failures. That information was most necessary; and one must not allow the matter to rest there or allow the customer to think that the firm could not produce good castings. A failure might not be the fault of the foundry, but rather of the design, or of the use of unsuitable material.

It was true, as mentioned by Mr. Delport, that some buyers knew little about the technicalities of the products they were buying. But in most businesses, where a buyer had not that knowledge, he was advised by a committee, including the works manager, the engineer or production engineer, who would meet weekly to deal with the problem of purchasing. The buyer was advised from the technical angle with regard to the products, so that he could

secure the best value at the lowest possible cost.

The suggestion made by Mr. Kent, that the foundry manager should visit the customer, was also good, because the more the foundry people were able to meet the actual users of their products, the more would they appreciate the viewpoint of the users, and the less would they be likely, when they received a complaint, to feel that the customer just did not know what he wanted. Mr. Templeton agreed with Mr. Kain in not advocating the yield point as the main criterion in selling.

Replying to Mr. Beech, he said that purchasing agents were at times very difficult, but, by and large, they were a well-balanced body of men. If the facts were placed before them in the proper manner, they would give the salesman all the hearing that was necessary. Undoubtedly a good salesman was born and not made. There were some men who possessed excellent technical knowledge of their products, but who could not "put over" these selling points to the buyer, so that the value of their technical knowledge was lost. A good salesman was usually a commercial man possessing technical knowledge and the ability to put before the buyer the essential points of the product he was selling.

Vote of Thanks

Mr. J. Ferdinand Kayser, proposing a vote of thanks to Mr. Templeton for his Paper, said that there still remained a few buyers of the type which could be defined only by using terms of abuse. Fortunately, a very different class of buyers and salesmen from those of the past had come into being. The first "cog" in an organisation was the buyer of materials; then there were the moulders, the fettlers and all the other workers in the organisation, until one came finally to the representative who was chosen to meet the customers, and, naturally, he was a most important individual.

It seemed that Mr. Templeton and all who had taken part in the discussion were at one in their views on merchandising, and it was pleasing to be able to propose a vote of thanks to a lecturer who had inaugurated such a discussion. Mr. Templeton obviously believed in the technical attack; Mr. Faulkner, on the other hand, had introduced the angle of friendship in selling. Those and the other aspects mentioned were equally important; and it would be agreed that success was achieved by people who could make the technical attack and could at the same time make friends with the men to whom they were endeavouring to sell.

The vote of thanks, which was seconded by Mr. B. B. Kent, was carried with acclamation, and Mr. Templeton briefly responded.

Catalogues Received

Conveyors. A leaflet received from Hugh Wood & Company, Limited, of Gateshead-on-Tyne, describes and illustrates a fully-troughed bottom-belt gate conveyor.

Non-Corroding Steels. A logical classification has been utilised for the production of a well-printed catalogue issued by Hadfields, Limited, of Sheffield, dealing with this subject of non-corroding or stainless steels, as they are quite commonly called. The classification embraces six types, of which No. 5, or "ERA" C.R.2, relates to castings and is the subject of numerous illustrations. There is a wealth of data in the brochure covering resistance to chemical attack, forging, cold-working, riveting, machining, grinding and welding. Among the castings illustrated, there are pump components, conveyor sprocket wheels, valve seatings for water-gas plant and other valve components, road studs, and the like. The brochure attains a very high level in trade literature.

Annual Meeting of Lancashire Foundrymen

NEW OFFICERS ELECTED

The annual general meeting of the Lancashire Branch of the Institute of British Foundrymen was held in Manchester on April 6, Mr. A. L. Key presiding over a large attendance of members.

After the minutes of the last annual meeting and the financial statement had been adopted, Mr. A. Boyes (hon. secretary) presented his report, the main points of which are abstracted below.

Average Attendance Over 80

It is to the credit of the Institute and to the Lancashire Branch in particular that they decided, despite war conditions, to proceed with the winter syllabus as far as possible. With the exception of the annual social and two works' visits, which were cancelled, a full programme has been carried out. The lectures have been well supported, and an average attendance of over 80 has been recorded.

The Branch membership has increased from 370 to 386, despite five resignations. During the year, the Branch suffered an irreparable loss through the death of one of its oldest and most respected members, Mr. W. H. Sherburn. Although there has been an increase in subscriptions of £11 5s., there is still much room for improvement. It is essential that subscriptions be paid promptly, as the cost of running the Institute may be greatly increased owing to the war.

Members will recall with pleasure the delightful outing to Skipton and Bolton Abbey in June; although the weather was unkind, it did not deter those who were present from having a thoroughly enjoyable time. The annual dinner in February, though less well attended than usual, can also be counted an outstanding success, and admiration was generally accorded to the President and members of the Dinner Committee for their courage in organising it. It was attended by 92 members and guests.

Medal and Diploma Awards

The R. A. Jones Medal was awarded to Mr. A. Phillips, and the diploma of the Institute was received by three members for Papers they presented to the Lancashire Branch. Mr. Laurie, Mr. Hodgson and Mr. West were the recipients, Mr. West and Mr. Hodgson presenting a joint Paper.

The Publication Committee are once again to be commended for the excellence of the winter syllabus handbook.

The Burnley Section has had a successful year, although the January and February lectures were cancelled owing to the black-out. The expenditure of the Section has again been decreased.

The report concludes with an expression of thanks to the President (Mr. A. L. Key), the former hon. secretary (Mr. J. E. Cooke), and all the members of the Branch Council for their assistance in what has proved to be a very difficult and trying year.

The report having been adopted, Mr. A. Phillips proposed a vote of thanks to the retiring officers for their splendid work during the session. He said they had kept the Branch in a remarkably efficient state of organisation. He particularly mentioned the services rendered by Mr. A. L. Key. The Branch was fortunate that during the late winter black-out they had had such a large number of well-seasoned officers at the head of their affairs. The statement had been made by Mr. Key that meetings would be held even if only six members attended them, and it was largely due to his leadership, as well as to the interesting Papers read, that the arrangements for the meetings had proved to be so good.

Associated with their thanks to Mr. Key he thought it was incumbent upon them to include further thanks to Mrs. Key for her assistance in making the social functions so successful. The members all looked forward to Mr. Key's continued presence at the meetings.

Mr. E. Longden, in seconding, declared that the enthusiasm evinced, and the efforts put forward, by Mr. Key were those of a youthful and ambitious member of the Institute. They were a fine example to the younger members.

The vote of thanks was carried unanimously, and in his response Mr. Key reminded them that the office of President was not entirely a one-man job, and he thanked the Hon. Secretary and the Council members as well as the members generally who had helped to make what might have been a very arduous task a somewhat easier one.

Election of Officers

The retiring President moved that Mr. W. Holland (Senior Vice-President) be inducted into the Presidential Chair. Mr. Holland had already been recommended for that office by the Branch Council, and he had much pleasure in inviting him to take office.

Mr. Holland then took the chair, and thanked the members for the confidence they had reposed in him. His sincere wish was that the coming session would be equally if not more successful than those which had preceded it.

Mr. E. J. L. Howard (Junior Vice-President) was elected Senior Vice-President, and Mr. J. E. Cooke (ex-Hon. Secretary) was appointed Junior Vice-President of the Branch.

The election of the following unopposed officers was confirmed:—Mr. A. Boyes, Hon. Secretary and Treasurer; Mr. F. A. Harper, Assistant Secretary.

Upon a ballot being taken the following officers were elected:—*Members of the Council*—Mr. A. Hopwood, Mr. A. Sutcliffe, Mr. J. Taylor, and Mr. A. L. Ollier. *Representatives on General Council*—Mr. W. N. Cook, Mr. J. Jackson, Mr. R. A. Jones, and Mr. A. Phillips. *Representatives on Technical Committee*—Mr. J. Jackson and Mr. A. Phillips. *Honorary Auditors*—Mr. R. R. Hargreaves and Mr. A. Hopwood.

The business of the annual general meeting then concluded.

New Japanese Blast Furnaces

The first 1,000-ton blast furnace of the Hirohata Ironworks of the Japan Iron Manufacturing Company is reported to be in operation. Immediately following the completion of a second 1,000-ton blast furnace, this concern intends to embark on the next stage of its production-expansion programme, which will involve the erection of two more 1,000-ton blast furnaces.

Swedish Industrial Survey

The Swedish Department of Commerce has published a statistical survey of the country's industries as at the beginning of 1939, together with final production statistics for 1938. According to this survey, there were, on January 1, 1939, 92 iron-ore mines in operation, employing 10,748 miners, with a total output in 1938 valued at 217,500,000 kr. Iron and steel works totalled 63, with 27,344 workers and an output value in 1938 of 360,900,000 kr. Manufacturers of iron and steel products (except engineering firms) totalled 1,007, with a total of 27,901 workers and an output valued at 251,250,000 kr., including 475 sheet mills with 6,650 workers and an output value of 59,600,000 kr.

War Savings Groups for employees

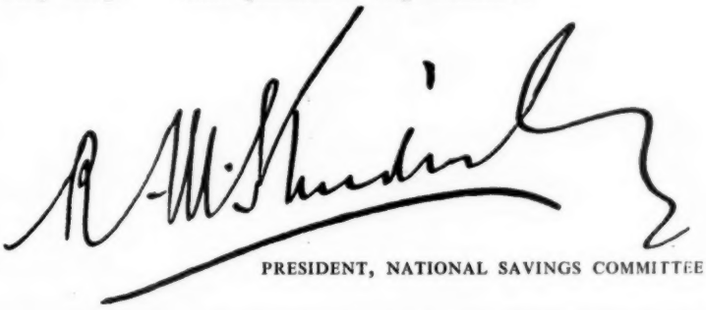
AN APPEAL TO BUSINESS MEN

May I appeal to all employers of labour in this country to give a hand in the War Savings Campaign by forming War Savings Groups for their people. Savings Groups are easy to form and simple to run.

The purpose of the campaign is to raise money for the war by producing a steady flow of regular weekly savings. These savings are lent to the State. They help to keep the finance of the nation sound. They help to prevent an undue rise of prices. They help to maintain and increase our Export Trade. In short they help to win the war.

The National Savings Committee will be glad to assist employers and their staffs in establishing a Savings Scheme to suit their particular requirements.

WRITE TODAY FOR FULL INFORMATION ON HOW TO FORM A SAVINGS GROUP



PRESIDENT, NATIONAL SAVINGS COMMITTEE

POST THIS COUPON TO THE HON. SEC. OF YOUR LOCAL SAVINGS COMMITTEE OR TO THE NATIONAL SAVINGS COMMITTEE, LONDON, S.W.1.

COUPON Write in pencil and in BLOCK letters.

I/we wish to form a National Savings Group in my/our firm, factory, office, shop. The total number of people employed is approximately.....
Please send details of suitable schemes.

Signature(s)_____

_____

Name of Firm_____

Address_____

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ISSUED BY THE NATIONAL SAVINGS COMMITTEE

The Week's News in Brief

Trade Talk

A RECORD MEMBERSHIP of 12,203 is reported by Mr. Alan Findlay, general secretary of the United Patternmakers' Association, in his monthly report.

THE NOMINAL CAPITAL of Ratcliffs (Great Britain), LIMITED, manufacturers of wrought iron and steel tubes, has been increased by £50,000 in £1 shares to £300,000.

AMONG the newly-formed export groups, announced by the Board of Trade last week, is one for ironfounders (light castings). The chairman is Mr. W. Blair, M.C., and the secretary Mr. J. Galbraith-Sneddon, 145, St. Vincent Street, Glasgow, C.2.

A NEW Department of Light has been formed at the National Physical Laboratory to comprise the former Optics Division of the Physics Department and the Photometry Division of the Electricity Department. Mr. T. Smith, F.R.S., has been appointed Superintendent of the new department.

AN APPLICATION for a wage advance of 15s. a week, made by craft unions in the Clyde valley, was considered at an arbitration court in Glasgow on April 16. Patternmakers and foundry workers are represented in the application. The finding of the court will probably be announced next week.

THE ANNUAL REPORT of the Barrow Hematite Steel Company, Limited, states that the agreement with Colvilles, Limited, of Glasgow, by which, as part of an exchange of products, the company will cease to operate its heavy and merchant mills for a period of ten years will come into operation three months after the cessation of hostilities. Operation of the agreement was suspended at the outbreak of war.

MR. G. R. BASHFORTH was re-elected President of the Staffordshire Iron and Steel Institute at Dudley recently. Mr. H. A. MacColl, lecturer in metallurgy at Wednesbury County Technical College, was appointed secretary, in succession to Dr. E. C. Rollason, of Birmingham, who is taking up a new position in London. Mr. T. Hoskison was re-elected treasurer. The secretary's annual report revealed an increase in membership, which is now 253.

SPEAKING at the annual dinner of Keighley Association of Engineers, Mr. J. E. Raistrick said the machine-tool section of the engineering industry had been the most neglected in proportion to its national usefulness. There was no country in the world that could teach Keighley or England anything in machine-tool design, when one spoke in terms of high-class machines. Keighley men had emigrated, and some of the finest firms in America had been founded by them. If those people had been encouraged, those large industries might well have been in Britain. Mr. Raistrick said there were less men employed in the machine-tool trade at the beginning of this war than there were 25 years ago, and in most of our important factories 60 to 75 per cent. of the machine tools used had been made abroad. This state of affairs must be remedied. If we were going to win the peace, we had to look into this question very closely.

THE EFFECT of the inclusion of a standards costing clause in contracts with members of the Steel Castings Manufacturers' Association is discussed by the Comptroller and Auditor-General in his report on the Royal Ordnance Factories' accounts for the year ended March 31, 1939. It was agreed to include the clause, owing to the uniformity of tendered prices, in contracts placed in May and September, 1937. Investigation disclosed considerable variation in costs, and it was agreed that the costs of all contractors should be averaged and the contracts settled by payment to each contractor of that average cost plus a uniform profit. The result was that the total cost was higher than if a settlement with each contractor had been based on his own costs, plus the agreed rate of profit, subject to the maximum price. As the costings clause is embodied in each contract, it appears that each contractor's prices should be considered in relation to his own costs, and the Comptroller and Auditor-General has asked the Ministry of Supply, to whom responsibility for these contracts was transferred, whether it is considered that the War Office contracted to determine the price by the method actually adopted.

Personal

MR. E. W. SPALDING has been appointed general sales manager of Ruston & Hornsby, Limited, Lincoln.

MR. JOHN ROXBURGH has now taken up his new position, announced last autumn, as foundry manager to Ley's Malleable Castings Company, Limited, Derby.

MR. COLIN LAYCOCK, chairman and managing director of J. Beardshaw & Son, Limited, Baltic Steelworks, Sheffield, has been elected President of the Sheffield Chamber of Commerce.

MR. G. I. RUSHTON, works manager of the Whitehead Iron & Steel Company, Limited, has been appointed group production manager of the main organisation and its subsidiary companies.

SIR WILLIAM J. FIRTH, KT., who recently relinquished the managing directorship of Richard Thomas & Company, Limited, but continued to act as chairman of the company, has now ceased to hold that position.

MR. MATTHEW BROWN, managing director of the Shotts Iron Company, Limited, has intimated his intention to retire from active executive duties towards the end of the year. He is to continue to serve as a member of the board of directors.

MR. C. P. LISTER, who has been appointed a director of the English Commercial Corporation, Limited, formed by the Government to stimulate trade with the Balkan countries, is chairman and managing director of R. A. Lister & Company, Limited, engineers and ironfounders, of Dursley.

MR. JOHN ROGERS (now on Government service), Mr. J. G. Nicholson and Lord Melchett, directors of Imperial Chemical Industries, Limited, have been appointed deputy-chairmen of the company. Mr. F. W. Bain and Mr. A. J. Quig, executive managers, have been appointed directors. Lord McGowan is chairman of the company. The appointment of deputy-chairmen is a new development in the administration of the company.

Wills

COGHLAN, C. ST. JOHN, late chairman of the Coghlan Steel & Iron Company, Limited, Leeds	£43,445
DRONSFIELD, WM., of Sandiway, chairman of Dronsfield Bros., Limited, ironfounders and engineers, of Oldham, Lancs	£84,274

Obituary

MR. JAMES MOFFAT, for 30 years an ironmoulder at the Callendar Ironworks, Falkirk, has died at the age of 91.

MR. PERCY FITZ-PATRICK ROWELL, formerly secretary of the Institution of Electrical Engineers, died recently, aged 65.

MR. ROBERT RUSSELL, managing director of Russells Brass Foundry, Limited, Motherwell, has died at the age of 65 years.

MR. ALBERT FRANCIS DRINKWATER, of the British Oxygen Company, Limited, Rosehill Works, Polmadie, Glasgow, has died.

FLYING-OFFICER NIGEL STUART GRAEME, who had been assistant sales representative in Scotland for British Timken, Limited, the bearing manufacturers, from September, 1938, until the outbreak of war, has been killed in an aircraft accident in France.

WE REGRET to announce the death of Mr. J. M. Moorwood, governing director of John M. Moorwood, Limited, Eagle Foundry, Sheffield, at the age of 78. He was the second son of Mr. Thomas Parkin Moorwood, one of the founders of Marshall, Watson & Moorwood, a Sheffield firm of ironfounders. After a period with his father's firm, Mr. J. M. Moorwood founded the firm to which he gave his name. It specialises in the manufacture of chilled, grain, and special alloy rolls. Mr. Moorwood was connected with Sheffield Chamber of Commerce for over 20 years and had been President of the Sheffield Ironfounders' Association since 1931. He was a Freeman of the Cutlers' Company.

Company Meetings

Coltness Iron Company, Limited

Presiding at the recent annual meeting of the Coltness Iron Company, Limited, MR. J. HAMILTON HOULDSWORTH (chairman) said that their steel and iron foundries were in full production. This position was not so at the beginning of the year, but, since war broke out their foundries had been fully employed. The Scottish Non-Ferrous Tube Industries, Limited, in which they were interested along with Imperial Chemical Industries, Limited, was now successfully producing a large output of non-ferrous tubes with satisfactory results.

Manganese Bronze & Brass Company, Limited

The annual meeting of the Manganese Bronze & Brass Company, Limited, was recently held in London. MR. J. C. COLQUHOUN (chairman) recalled that last year he mentioned that in one section of their business they were faced with the alternatives of heavy expenditure on new equipment or dropping out of that particular market over the next few years. They decided on the former course, and fortunately so, because the volume of orders in hand in this particular section had more than doubled since the war began, and, directly or indirectly, this increase largely represented work for national purposes. On the marine propeller side of their business, work continued at high pressure throughout the year and production reached a record figure. The new moulding process, introduced in the previous year, had given highly satisfactory results. On the outbreak of war certain extensions were put in hand which would have the effect of increasing the productive capacity of their propeller business by about the middle of this year.

Reports and Dividends

Dennis Bros., Limited—Interim dividend of 33½ per cent.

Walmsleys (Bury), Limited—Interim dividend of 6 per cent.

Murex, Limited—Interim dividend of 7½ per cent. on the ordinary shares.

Yorkshire Engine Company, Limited—Trading profit, £4,725; brought in, £11,684; carried forward (subject to E.P.T. and depreciation of back years), £16,410.

Ransomes & Rapier, Limited—Net profit for 1939, £22,502; final dividend of 4 per cent., free of tax, on the ordinary shares, making 6½ per cent., free of tax.

Engineers & Ironfounders, Limited—Net revenue for 1939, £5,846; brought in, £9,696; final ordinary dividend of 7½ per cent., making 10 per cent., plus a bonus of 1s. a share; carried forward, £10,675.

C. & W. Walker, Limited—Profit for year to January 31 last, £17,620; brought in, £10,602; dividend on the preference shares of 7½ per cent., £3,000; dividend on the ordinary shares of 10 per cent., £9,530; bonus on the ordinary shares of 6d. per share, £2,382; carried forward, £13,309.

Colvilles, Limited—Trading profit, after writing down investments and providing for contingencies, £1,058,462; dividends from subsidiaries, £147,522; brought in, £292,081; depreciation and obsolescence, £350,000; taxation, £600,000; dividend on the 5½ per cent. cumulative preference stock, £75,625; interim dividend of 3 per cent. on the ordinary stock, £76,431; final dividend of 5 per cent., less income tax, making 8 per cent. for the year 1939.

Forthcoming Events

MAY 2-3.

Iron and Steel Institute:—Anual meeting in London at offices of the Institute, 4, Grosvenor Gardens, at 10 a.m. Members' luncheon on Friday at Grosvenor House, Park Lane, at 1 p.m.

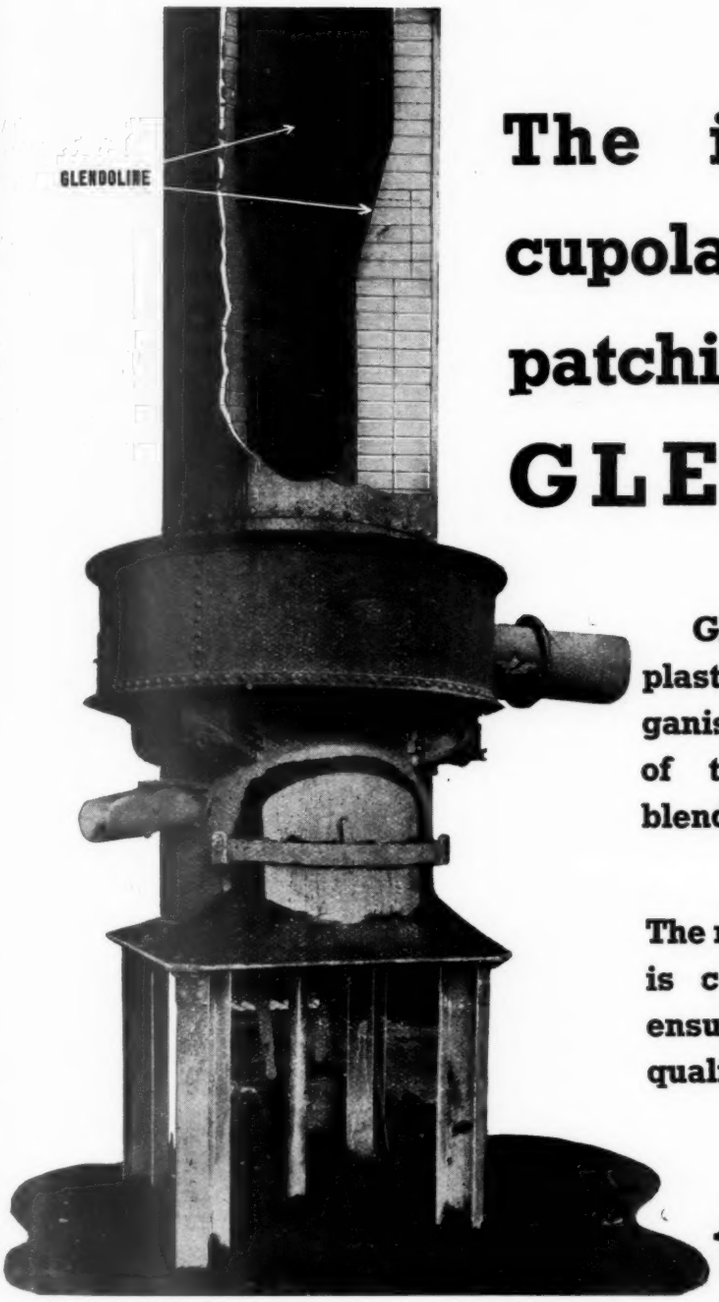
Institute of British Foundrymen

APRIL 26.

Birmingham, Coventry and West Midlands Branch:—"Some Experiences with Cupolas," Paper by L. W. Bolton, at James Watt Memorial Institute, Great Charles Street, Birmingham, at 7 p.m.

APRIL 27.

West Riding of Yorkshire Branch:—Annual general meeting, and discussion on foundry problems, at Technical College, Bradford, at 6.30 p.m.



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The mixing and grading of Glendoline is controlled to a definite formula, ensuring dependable and uniform quality.

★ EXTREMELY PLASTIC

★ HIGHLY REFRACTORY

★ GREAT MECHANICAL STRENGTH

★ This photograph of a cupola, shows a portion of the lining and the positions where Glendoline is recommended for lining and patching.

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Raw Material Markets

In view of the need for maintaining outputs during the summer months, serious consideration is already being given to the question of workers' holidays in the heavy industries. The desirability of giving employees paid holidays is generally recognised, but there can be no break in operations. Consequently, vacations are likely to be "staggered" this year. At a conference in Birmingham on Friday of representatives of the Engineering and Allied Employers' Association with delegates of the trade unions, arrangements were made to facilitate the "staggering" of summer holidays in the engineering industry in the Midlands. A similar arrangement is expected to be introduced for Scottish steelworkers. All departments of the iron and steel industry continue to return good production figures.

Germany appears to be losing the iron-ore war as a result of her Norwegian campaign. None of this valuable war material is now being shipped from the ports of Norway, but Britain is in the fortunate position of having alternative resources. The blow has undoubtedly fallen more heavily on the aggressors, and there is also the possibility of a resumption of exports from Narvik to Britain if the Allies continue to make the present rate of progress.

Pig-Iron

MIDDLESBROUGH—Iron for foundries in this area is coming through from the Midlands in satisfactory tonnages to meet the demand brought about by the cessation of Cleveland iron production. Ironmakers here are fully employed on the production of iron for other purposes, and at present furnaces cannot easily be transferred to the manufacture of foundry iron. There is strong pressure for supplies of hematite, but there is not a great deal to spare after the needs of the steelworks have been met. The export market is completely suspended for the time being; formerly the overseas outlet for North-East Coast hematite was extensive.

LANCASHIRE—More active conditions are reported in certain sections of the pig-iron consuming trades. Only a slight improvement is noticeable in the light-castings trade, but a decided quickening of operations has been apparent at many of the jobbing foundries in this area during the past few weeks. Order-books among makers of textile machinery now appear to be better filled. There is no relaxation of the very active conditions which have prevailed among the speciality engineering concerns for some time past, and the outlook suggests a continuance of brisk operations. A steady demand for West Coast hematite is reported, and deliveries are being made satisfactorily.

MIDLANDS—Only a small tonnage of high-phosphorus iron is passing to engineering concerns, and, as the light-castings trade continues to be badly placed for work, there is only a very moderate demand for this type of iron. The building industry seems unlikely to revive to any extent under present conditions, while the export trade formerly carried on by makers of light castings has been hard hit by the war, although it is hoped that the overseas business will be developed at an early date. The Government may also be able to find some work for this section at a future period, but meanwhile conditions are slow. Heavy engineers in the Midlands, however, are working to capacity, as is indicated by the strength of the demand for low-phosphorus iron and hematite. Most of these works are almost solely occupied on contracts placed by Government departments. Supplies of iron for these users are not forthcoming too freely, although a slight improvement has recently occurred, outputs of certain furnaces having been raised.

SCOTLAND—It would appear that the combined efforts of light-castings makers to secure a share in the Government munitions programme may have satisfactory results, as an official of the Ministry of Supply is to visit Falkirk to negotiate with producers. If the industry is to be able again to operate at peacetime levels there will have to be placed more Government work than is actually likely to be forthcoming, but in the present depressed conditions even small contracts will be appreciated. Other iron users in the area are busy and the demand is heavy. On the whole, however, there is little delay in acquiring supplies, although the trade necessarily operates on a hand-to-mouth basis, with little, or no, opportunity for building up stocks.

Coke

The foundry-coke market is exceptionally strong for the time of the year. Users are buying tonnages to put into stock in addition to meeting their current substantial requirements. The controlled minimum price of Durham foundry coke is 50s. 3d. per ton, delivered to Birmingham and Black Country stations. Any change is likely to be in an upward direction, but makers cover themselves against this by the inclusion of a rise-and-fall clause in contracts.

Steel

A statement made by an official of the steel trade this week reveals that the new distribution scheme will be in full operation by the middle of the year. This is the desire not only of the Government, but of producers and consumers, too, as it is appreciated that the plan is likely to go a long way towards obtaining maximum efficiency from the industry. At the same time the scheme is complicated, and as yet there is some misunderstanding as to the operation of the plan, but with the collaboration of all concerned this should soon be eradicated. The outputs of the steelmakers are being taken up as they become available, and works have on hand orders sufficient to keep them fully occupied for months ahead.

Scrap

The search for scrap iron and steel is still being pursued with vigour, as it is apparent that there are still large tonnages which have not yet been offered. Various areas are being combed systematically, but this is inevitably a slow operation. Imports are assisting, but it is hoped to keep foreign scrap supplies at a minimum level, owing to the cost and the bulky nature of these cargoes.

Metals

Information released in London last week reveals the extent of American exports to the U.S.S.R. through the port of Vladivostock since the outbreak of the war. In peacetime the American trade to Vladivostock was very small. Since the war, however, a new export trade has sprung up in copper, aluminium, tin, rubber, and molybdenum and also in special tools essential to the armament industry. In 1938 the United States sent no aluminium, no tin, and only 50 tons of copper to Russia. A large quantity, some 3,000,000 lbs., of molybdenum reached Russia from the United States indirectly. But the exports from the United States to Vladivostock from the beginning of the war to March were: Copper 60,000 to 70,000 tons, rubber 6,000 tons, tin 2,200 tons, molybdenum 6,000,000 lbs., and at least 1,600 tons of aluminium. The rubber and tin exports ceased about February owing to the action of the United States in conserving supplies for herself. The estimated annual requirements of Russia before the war were: Copper 60,000 to 80,000 tons, rubber 25,000 to 30,000 tons, and molybdenum 3,000,000 lbs. It is estimated that since the war began Russia has received at Vladivostock from all sources of supply: Copper 60,000 to 70,000 tons, tin 7,500 tons, rubber 40,000 tons, molybdenum 6,000,000 lbs. These figures show that, except for rubber and tin, some of which arrived from Siam and the Dutch East Indies, Russia has obtained her supplies from the United States.

An example of the way in which commodities have been transported to the Soviet Union is given in the instance of a cargo of American copper which was exported first to Mexico, where it was later transhipped and taken to Vladivostock. In another case, tin from the Dutch East Indies was shipped to the Free Port at Staten Island, New York, and then transhipped to Vladivostock. American, Japanese, Norwegian and Italian ships were used. The amount of American commodities which has found its way to Germany is unknown.

The chief feature of the international copper market of late has been heavy Italian buying in the United States. These purchases, reported to involve 10,000 tons for May-June delivery and a similar quantity for delivery over the second half of the year, are not without interest at the present time. Since the placing of these orders the American export market has quietened down, while the home requirements are at a low ebb.

Consumption of tin in the United Kingdom is reported to be at a record level. Italy has been buying in the East, while a moderate demand on American account is reported. Uneasiness at the continued reduction in official warehouse stocks in the United Kingdom has been obvious of late, but the extent of invisible stocks remains unknown, and the position may be more satisfactory than it appears on the surface.

Metal Exchange prices for tin this week have been as follow:—

Cash—Thursday, £255 10s. to £255 15s.; Friday, £254 to £255; Monday, £252 15s. to £253; Tuesday, £253 10s. to £253 15s.; Wednesday, £254 5s. to £254 10s.

Three Months—Thursday, £249 10s. to £249 15s.; Friday, £248 to £248 10s.; Monday, £247 to £247 5s.; Tuesday, £249 to £249 5s.; Wednesday, £249 5s. to £249 10s.

The demand for spelter in this country is maintained at a high level. Some concern has been expressed as to the future of supplies from the Eitrheim works in Norway. It is unlikely that the Allies will obtain any further shipments from this source for a considerable time, but spelter will be forthcoming satisfactorily from the Empire. The difficulties of domestic lead users are not likely to be diminished by the Government's export drive, as a fairly large tonnage of the metal may be required for export, but the needs of the armament factories are being well met and no inconvenience in this respect will be allowed to develop.

EMPLOYMENT REGISTER.

Correspondence should be addressed to the General Secretary, Institute of British Foundrymen, St. John Street Chambers, Deansgate, Manchester, from whom full particulars can be obtained of this service.

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